ASSOCIATION OF BULK TERMINAL OPERATORS (ABTO)

DAY ONE

OPERATIONS AND OPPORTUNITIES

HANDLING CARGOES WITH A HIGH MOISTURE CONTENT

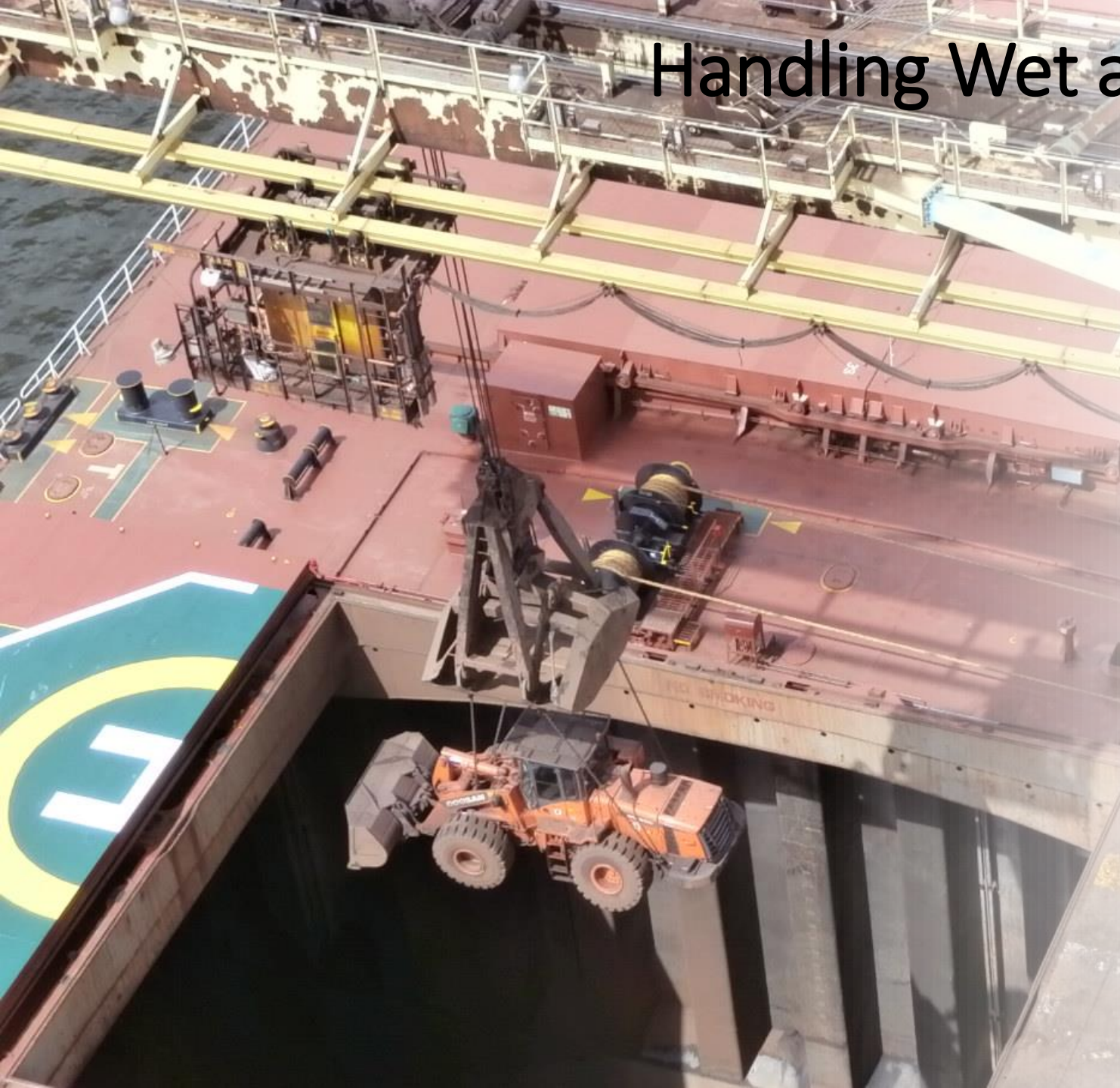
Handling Cargoes With A High Moisture Content

The dangers presented by high moisture content to the safety of bulk carriers due to Liquefaction is well known. This presentation however will examine the issues relating to the handling of bulk ore cargoes with a high moisture content and the challenges faced by bulk terminal operators in the handling and storage of such cargoes.

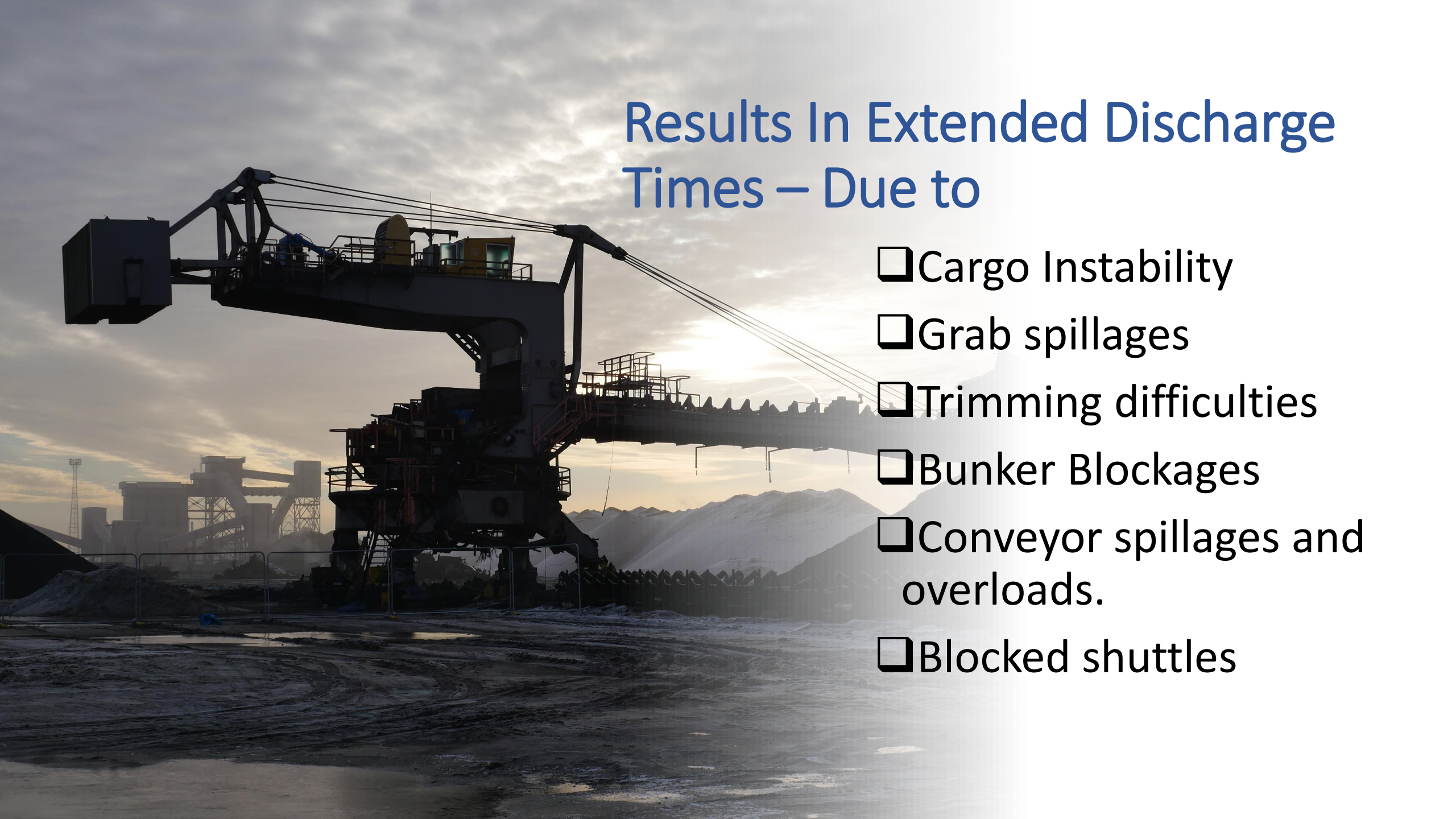
Wet Ore a Sticky Issue

- Problems associated with offloading cargoes with a high moisture content
- Storage issues associated with problem cargoes
- Examples of the problems encountered offloading cargoes of Brazilian ore and how they were dealt with by the terminal

Handling Wet and Sticky Ores (WSO)



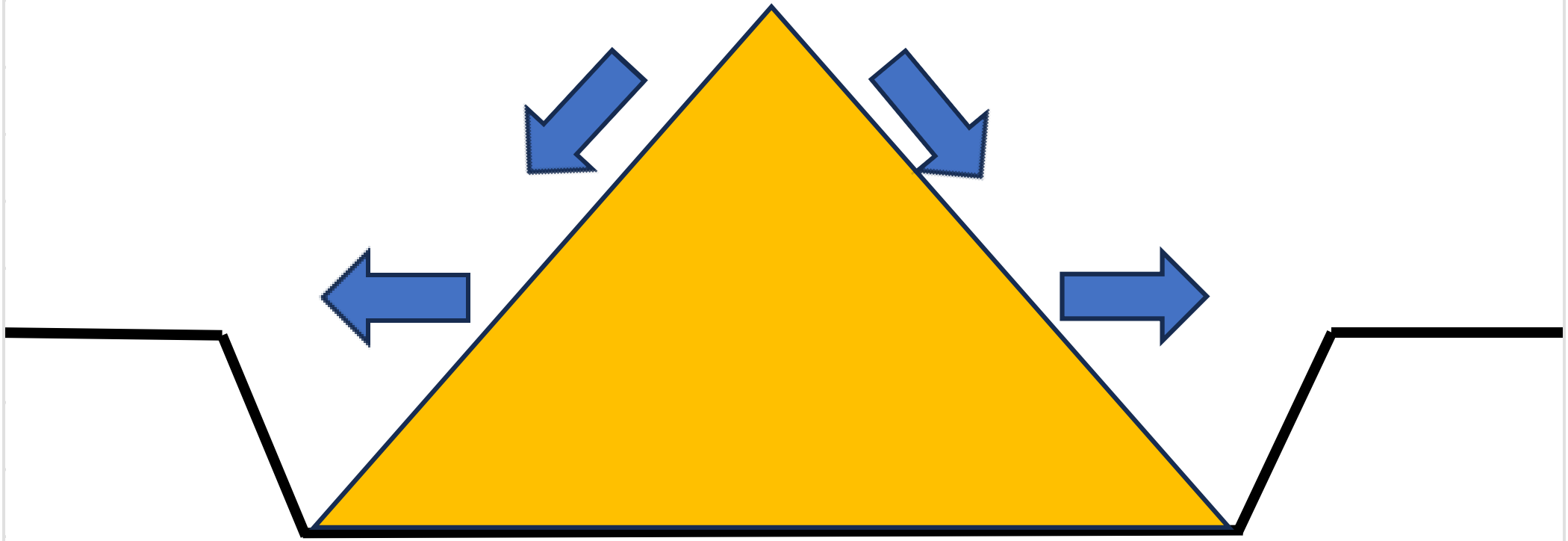
- Handling Wet and Sticky Ore (WSO) is a long-standing issue which has left many terminals struggling on how to address the problem.
- "WSO becomes a problem when sticky material clings to surfaces and dries.
- Handling WSO can significantly add to handling costs by causing equipment blockages and increasing asset maintenance requirements. It can also worsen machinery wear increasing terminal operating costs.



Results In Extended Discharge Times – Due to

- ❑Cargo Instability
- ❑Grab spillages
- ❑Trimming difficulties
- ❑Bunker Blockages
- ❑Conveyor spillages and overloads.
- ❑Blocked shuttles

Unstable Stock Pile



Increase risk of collapse

Pre- Shipment Checks On Ore Cargoes

It is a requirement for Bulk Shippers to sample and analyse a cargo to be shipped in order to determine its Transportable Moisture Limit TML

It is also a requirement to determine the actual moisture content MC of a cargo to be shipped.

TML - MC

- TML – Transportable Moisture Limit
- Defines the Transportable Moisture Limit For A Commodity
- A Certificate Showing the Transportable Moisture Limit is issued by the shipper.

- Moisture Content
- Defines the Actual Moisture Content of a Product at the time of shipment
- A Certificate showing the Actual Moisture Content of the cargo to be loaded is issued by the shipper prior to loading.

Validity Of TML and MC Certificates

In the event that a shipper intends to use a TML value of a material for more than one shipment – for example during a period wherein product, production methods and specifications of the material are guaranteed to be constant it is the sole responsibility of the shipper to ensure that the tested sample has the same characteristics and properties of the cargo that was sampled and tested. The period of validity will not be stated on TML certificates, but will report their results based upon the sampling and testing dates of the pertinent sample.

Validity of Actual Moisture Certificates
Sampling and testing for actual moisture content shall be conducted as near as practicable to the time of loading. If there has been significant rain or snow between the time of sampling and loading, check tests shall be conducted to ensure that the Actual Moisture content of the cargo is still less than its TML.

The interval between sampling/testing and loading shall never be more than seven (7) days.

Measuring Moisture Content

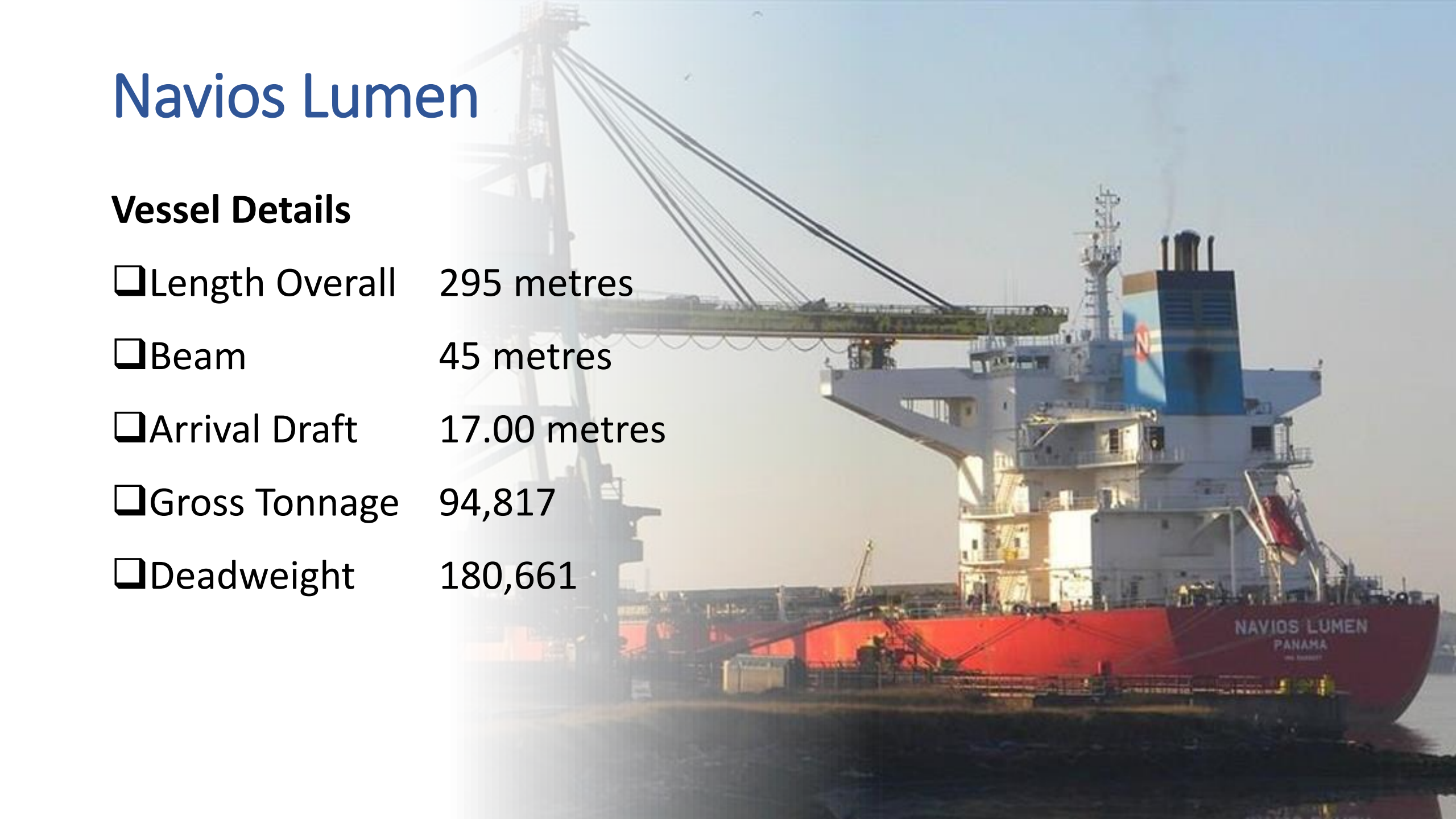
- ❑ Laboratory Test
- ❑ Simple Can Test

Typical Example

Navios Lumen

Vessel Details

- ❑Length Overall 295 metres
- ❑Beam 45 metres
- ❑Arrival Draft 17.00 metres
- ❑Gross Tonnage 94,817
- ❑Deadweight 180,661



Voyage and Cargo Details

Voyage Details

- Load Port Itaguai Brazil 19th January 2013
- Discharge Port Redcar UK - Arrived 15th February 2013

Cargo Details

- Bill Of Lading One Dated 19th January 2013
- Iron Ore Concentrate SSH7 82,479 WMT
- Bill Of Lading Two Dated 19th January 2013
- Iron Ore Concentrate SFNM 79,756 WMT
- Total Cargo 162,235 WMT

Hold	Tonnes
1	17,296
2	19,813
3	16,996
4	20,115
5	13,996
6	20,115
7	15,996
8	19,713
9	18,195
	162,235

- Brazil wet season Monsoon Oct - Mar
- Navios Lumen Loaded in January
- Bilge Pumping approx 375 tonnes

Bill Of Lading One

Navios Lumen.

BILL OF LADING

No. 01

NACIONAL MINERIOS SA

COPY NOT NEGOTIABLE

TO THE ORDER OF STANDARD BANK PLC

SAHAVIRIYA STEEL INDUSTRIES UK LIMITED
STEEL HOUSE REDCAR , CLEVELAND , UK TS10 5QW
ATTENTION : MR. CHALERM ANGKATIP

NAVIOS LUMEN — PORT OF ITAGUAI, BRAZIL

REDCAR, TEESSIDE, CLEVELAND, U.K.

WITH A CARGO OF 82,479 WMT OF IRON CONCENTRATE - SINTER FEED NAMISA - SSNT

"FREIGHT PAYABLE AS PER CHARTER PARTY"

Freight payable as per CHARTER PARTY dated 27th Dec 2012

SHIPPED at the port of loading in apparent good order and condition on board the vessel for carriage to the Port of Discharge or so near thereto as she may safely get the goods specified above.
Weight, measure, quality, quantity, condition, contents and value unknown.
IN WITNESS whereof the Master or Agent of the said Vessel has signed the number of Bills of Lading indicated below all of this tenor and date, any one of which being accomplished the others shall be void.

FOR CONDITIONS OF DAMAGE SEE OVERLEAF

CLEAN ON BOARD

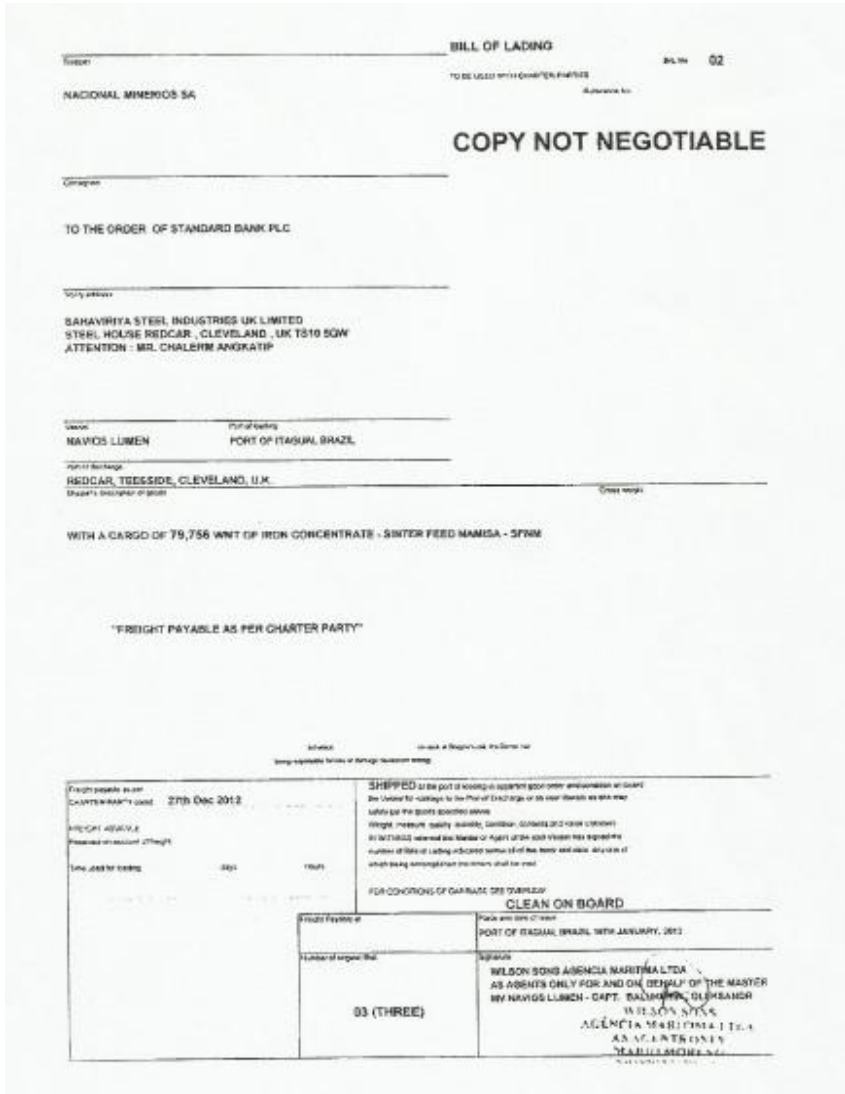
Freight Payable at

Place and date of issue
PORT OF ITAGUAI, BRAZIL 19TH JANUARY, 2013

Number of original Bs/L
03 (THREE)

Signature
WELSON SONS AGENCIA MARITIMA LTDA
AS AGENTS ONLY FOR AND ON BEHALF OF THE MASTER
MV NAVIOS LUMEN - CAPT. BALLANTYNE, GLENSANDA

Bill Of Lading Two



BILL OF LADING

No. 02

NACIONAL MINERIOS SA

COPY NOT NEGOTIABLE

TO THE ORDER OF STANDARD BANK PLC

SAHAVIRIYA STEEL INDUSTRIES UK LIMITED
STEEL HOUSE REDCAR , CLEVELAND , UK TS10 5QW
ATTENTION : MR. CHALERM ANGKATIP

Vessel: NAVIOS LUMEN — Port of loading: PORT OF ITAGUAI, BRAZIL

Port of discharge: REDCAR, TEESSIDE, CLEVELAND, U.K.

WITH A CARGO OF 79,756 WMT OF IRON CONCENTRATE - SINTER FEED NAMISA - SFNM

"FREIGHT PAYABLE AS PER CHARTER PARTY"

Freight payable as per CHARTER PARTY dated 27th Dec 2012

SHIPPED at the port of loading in apparent good order and condition on board the Vessel for carriage to the Port of Discharge or so near thereto as she may safely get the goods specified above.
Weight, measure, quality, quantity, condition, contents and value unknown.
IN WITNESS whereof the Master or Agent of the said Vessel has signed the number of Bills of Lading indicated below all of this tenor and date, any one of which being accomplished the others shall be void.

FOR CONDITIONS OF DAMAGE SEE OVERLEAF

CLEAN ON BOARD

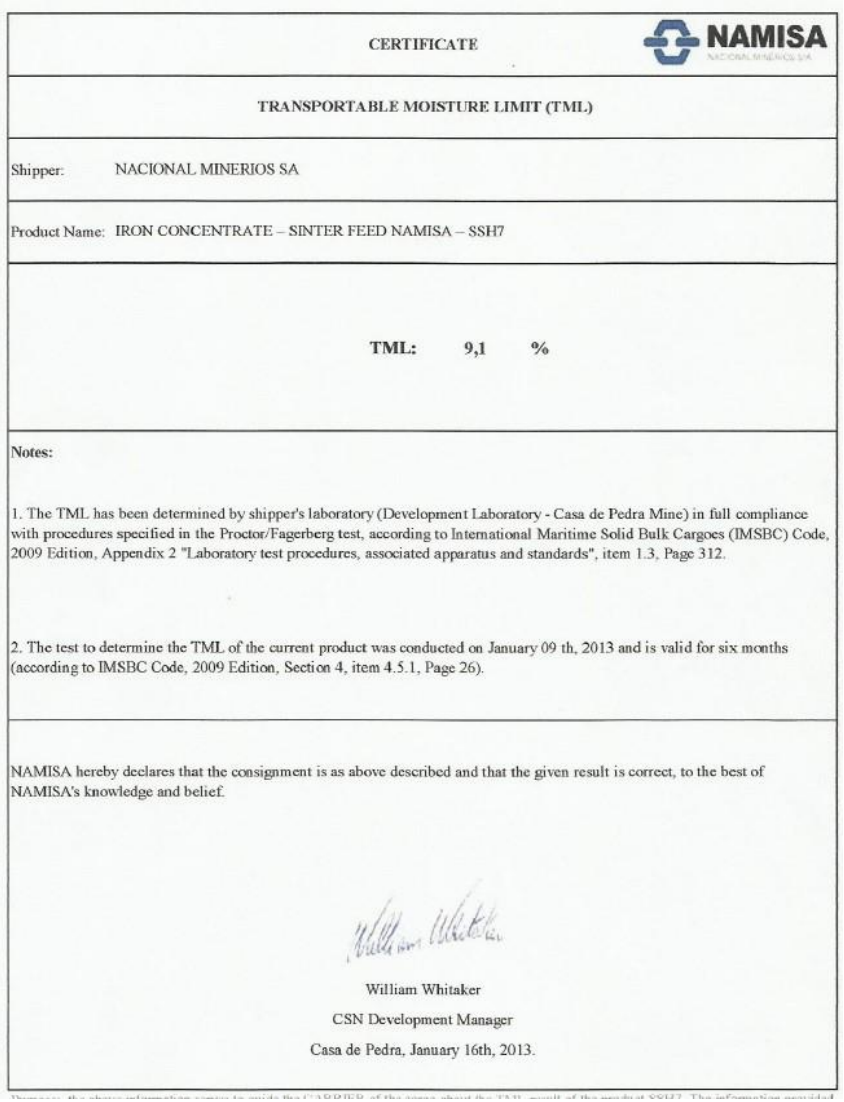
Freight Payable at

Place and date of issue
PORT OF ITAGUAI, BRAZIL 19TH JANUARY, 2013

Number of original Bs/L
03 (THREE)

Signature
WELSON SONS AGENCIA MARITIMA LTDA
AS AGENTS ONLY FOR AND ON BEHALF OF THE MASTER
MV NAVIOS LUMEN - CAPT. BALLANTYNE, GLENSANDA

Transportable Moisture Limit



CERTIFICATE

NAMISA

NACIONAL MINERIOS SA

TRANSPORTABLE MOISTURE LIMIT (TML)

Shipper: NACIONAL MINERIOS SA

Product Name: IRON CONCENTRATE – SINTER FEED NAMISA – SSH7

TML: 9,1 %

Notes:

1. The TML has been determined by shipper's laboratory (Development Laboratory - Casa de Pedra Mine) in full compliance with procedures specified in the Proctor/Fagerberg test, according to International Maritime Solid Bulk Cargoes (IMSBC) Code, 2009 Edition, Appendix 2 "Laboratory test procedures, associated apparatus and standards", item 1.3, Page 312.

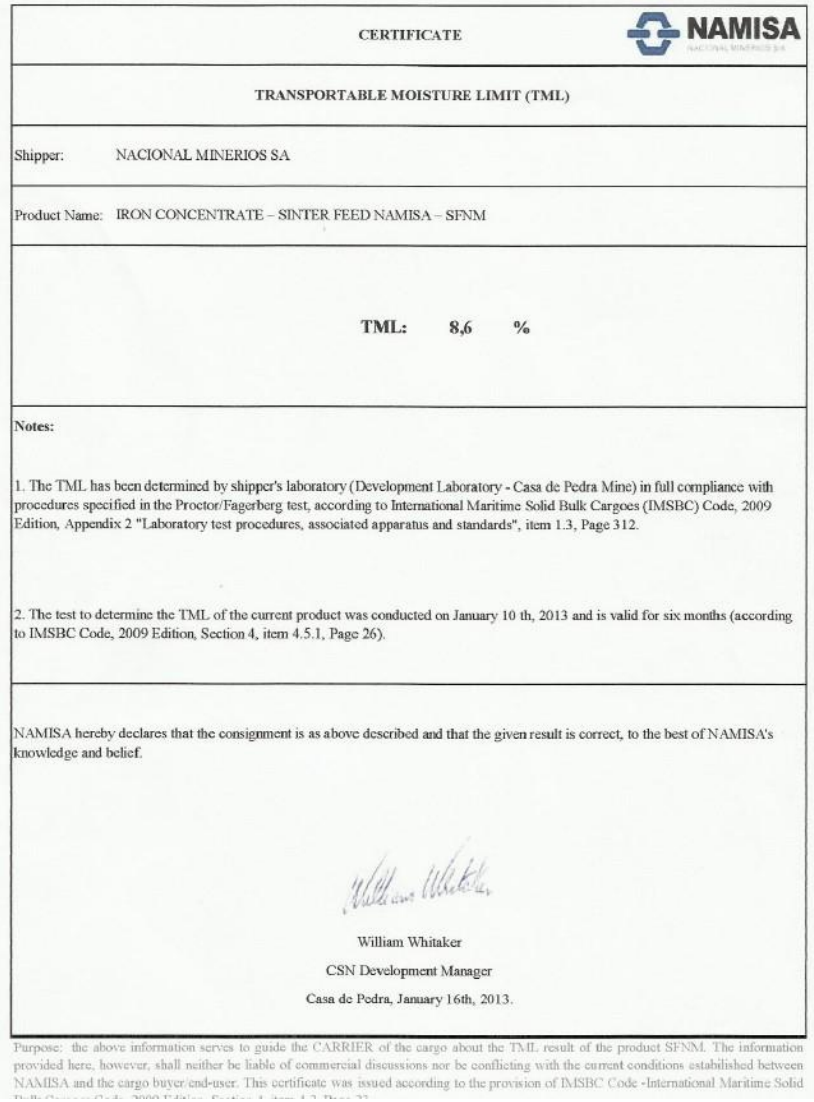
2. The test to determine the TML of the current product was conducted on January 09 th, 2013 and is valid for six months (according to IMSBC Code, 2009 Edition, Section 4, item 4.5.1, Page 26).

NAMISA hereby declares that the consignment is as above described and that the given result is correct, to the best of NAMISA's knowledge and belief.

William Whitaker

CSN Development Manager

Casa de Pedra, January 16th, 2013.



CERTIFICATE

NAMISA

NACIONAL MINERIOS SA

TRANSPORTABLE MOISTURE LIMIT (TML)

Shipper: NACIONAL MINERIOS SA

Product Name: IRON CONCENTRATE – SINTER FEED NAMISA – SFNM

TML: 8,6 %

Notes:

1. The TML has been determined by shipper's laboratory (Development Laboratory - Casa de Pedra Mine) in full compliance with procedures specified in the Proctor/Fagerberg test, according to International Maritime Solid Bulk Cargoes (IMSBC) Code, 2009 Edition, Appendix 2 "Laboratory test procedures, associated apparatus and standards", item 1.3, Page 312.

2. The test to determine the TML of the current product was conducted on January 10 th, 2013 and is valid for six months (according to IMSBC Code, 2009 Edition, Section 4, item 4.5.1, Page 26).

NAMISA hereby declares that the consignment is as above described and that the given result is correct, to the best of NAMISA's knowledge and belief.

William Whitaker

CSN Development Manager

Casa de Pedra, January 16th, 2013.

Purpose: the above information serves to guide the CARRIER of the cargo about the TML result of the product SFNM. The information provided here, however, shall neither be liable of commercial discussions nor be conflicting with the current conditions established between NAMISA and the cargo buyer/end-user. This certificate was issued according to the provision of IMSBC Code -International Maritime Solid

Moisture Content

CERTIFICATE — NAMISA

MOISTURE CONTENT (MC)

Shipper:	NACIONAL MINERIOS SA
Product Name:	IRON CONCENTRATE – SINTER FEED NAMISA – SSH7
Vessel:	NAVIOS LUMEN
Quantity:	75,000 WMT (+/-10%)

Moisture Content (MC): 8,2 %

Notes:

1. The MC is determined by shipper's laboratory at Itaguai Port, on a loading shipment basis. The procedure to determine the moisture content is conducted in accordance to *ISO 3087:2011, IRON ORES - DETERMINATION OF THE MOISTURE CONTENT OF A LOT.*

2. At the time this declaration is presented to the master or his representative the MC is, to the best of shipper's knowledge and belief, the average moisture content of the cargo to be loaded onto all vessel holds.

NAMISA hereby declares that the consignment is as above described and that the given result is the best estimative of the moisture of the relevant cargo to be loaded, to the best of NAMISA's knowledge and belief.

Raquel de Castro Guerra

CSN Laboratory Manager

Itaguai, January 16th, 2013.

Purpose: the above information serves to guide the CARRIER of the cargo about the MC result of the product SSH7. The information provided here, however, shall neither be liable of commercial discussions nor be conflicting with the current conditions established between NAMISA and the cargo buyer/end-user. This certificate was issued according to the provision of IMSBC Code – International Maritime Solid Bulk Cargoes Code, 2009 Edition, Section 4, item 4.2, Page 23.

CERTIFICATE — NAMISA

MOISTURE CONTENT (MC)

Shipper:	NACIONAL MINERIOS SA
Product Name:	IRON CONCENTRATE – SINTER FEED NAMISA – SFNM
Vessel:	NAVIOS LUMEN
Quantity:	75,000 WMT (+/-10%)

Moisture Content (MC): 8,2 %

Notes:

1. The MC is determined by shipper's laboratory at Itaguai Port, on a loading shipment basis. The procedure to determine the moisture content is conducted in accordance to *ISO 3087:2011, IRON ORES - DETERMINATION OF THE MOISTURE CONTENT OF A LOT.*

2. At the time this declaration is presented to the master or his representative the MC is, to the best of shipper's knowledge and belief, the average moisture content of the cargo to be loaded onto all vessel holds.

NAMISA hereby declares that the consignment is as above described and that the given result is the best estimative of the moisture of the relevant cargo to be loaded, to the best of NAMISA's knowledge and belief.

Raquel de Castro Guerra

CSN Laboratory Manager

Itaguai, January 16th, 2013.

Purpose: the above information serves to guide the CARRIER of the cargo about the MC result of the product SFNM. The information provided here, however, shall neither be liable of commercial discussions nor be conflicting with the current conditions established between NAMISA and the cargo buyer/end-user. This certificate was issued according to the provision of IMSBC Code – International Maritime Solid Bulk Cargoes Code, 2009 Edition, Section 4, item 4.2, Page 23.

TML / MC

Bill Of Lading One

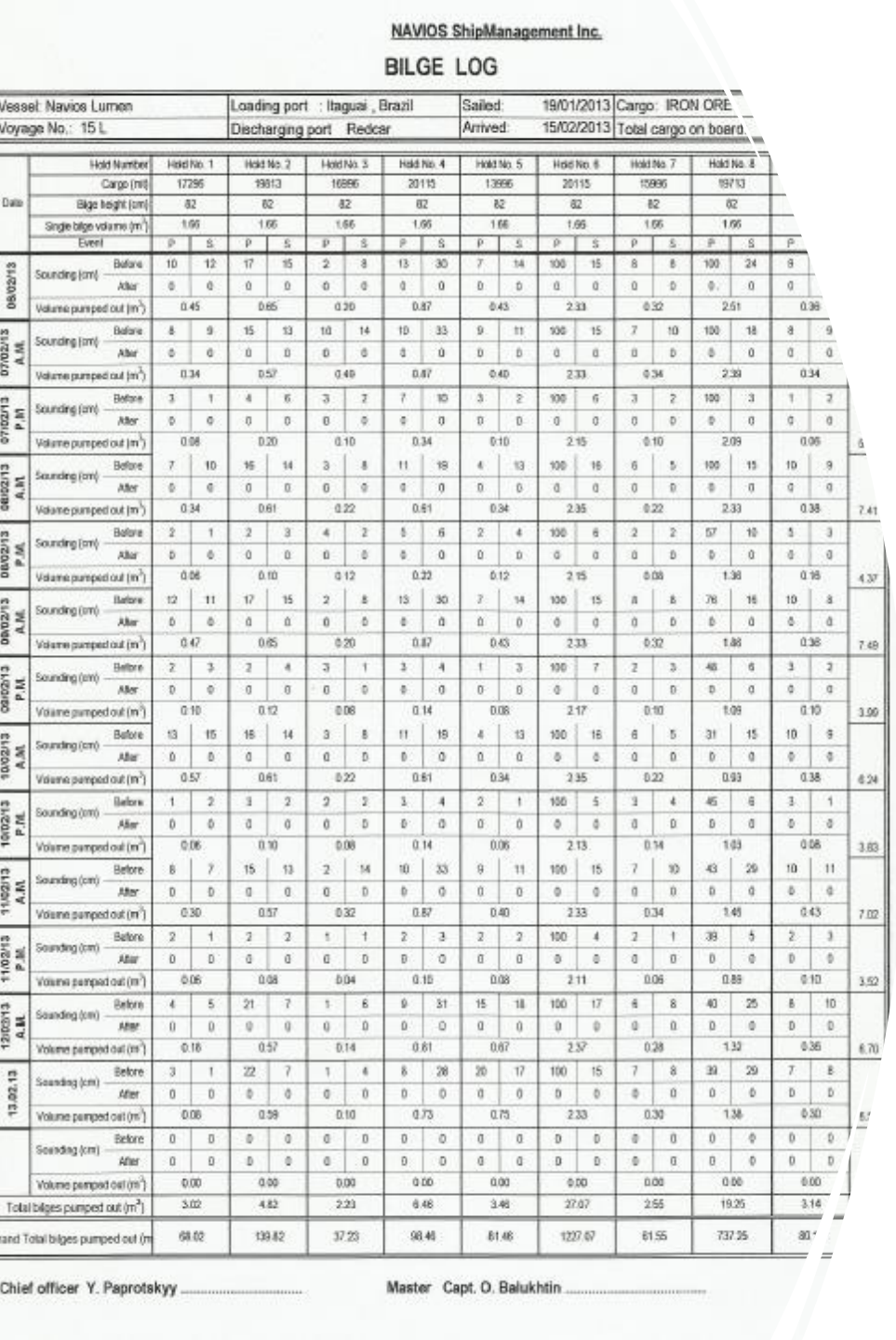
- TML 9.1 %
- MC 8.2 %

- Tonnes 82,479 Wet Tonnes
- MC 8.2% 6,763 Tonnes

Bill Of Lading Two

- TML 8.6 %
- MC 8.2 %

- Tonnes 79,756 Wet Tonnes
- MC 8.2% 6,540 Tonnes



NAVIOS ShipManagement Inc.

BILGE LOG

Vessel: Navios Lumen	Loading port : Itaguai , Brazil	Sailed: 19/01/2013	Cargo: IRON ORE		
Voyage No.: 15 L	Discharging port Redcar	Arrived: 15/02/2013	Total cargo on board		

Date		Hold Number	Hold No. 1		Hold No. 2		Hold No. 3		Hold No. 4		Hold No. 5		Hold No. 6		Hold No. 7		Hold No. 8		
		Cargo (mt)	17296		19813		16896		20115		13896		20115		15896		19713		
		Bilge height (cm)	82		82		82		82		82		82		82		82		
		Single bilge volume (m^3)	1.66		1.66		1.66		1.66		1.66		1.66		1.66		1.66		
		Event	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P
06/02/13	Sounding (cm)	Before	10	12	17	15	2	8	13	30	7	14	100	15	8	8	100	24	9
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.45		0.65		0.20		0.87		0.43		2.33		0.32		2.51		0.36
07/02/13 A.M.	Sounding (cm)	Before	8	9	15	13	10	14	10	33	9	11	100	15	7	10	100	18	8	9
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.34		0.57		0.49		0.87		0.40		2.33		0.34		2.39		0.34	
07/02/13 P.M.	Sounding (cm)	Before	3	1	4	6	3	7	7	10	3	2	100	6	3	2	100	3	1	2
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.08		0.20		0.10		0.34		0.10		2.15		0.10		2.09		0.06	5
08/02/13 A.M.	Sounding (cm)	Before	7	10	16	14	3	8	11	19	4	13	100	16	6	5	100	15	10	9
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.34		0.61		0.22		0.61		0.34		2.35		0.22		2.33		0.38	7.41
08/02/13 P.M.	Sounding (cm)	Before	2	1	2	3	4	2	5	6	2	4	100	6	2	2	57	10	5	3
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.06		0.10		0.12		0.22		0.12		2.15		0.08		1.36		0.16	4.37
09/02/13 A.M.	Sounding (cm)	Before	12	11	17	15	2	8	13	30	7	14	100	15	8	8	76	16	10	8
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.47		0.65		0.20		0.87		0.43		2.33		0.32		1.88		0.38	7.49
09/02/13 P.M.	Sounding (cm)	Before	2	3	2	4	3	1	3	4	1	3	100	7	2	3	46	6	3	2
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.10		0.12		0.08		0.14		0.08		2.17		0.10		1.09		0.10	3.99
10/02/13 A.M.	Sounding (cm)	Before	13	15	16	14	3	8	11	19	4	13	100	16	6	5	31	15	10	9
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.57		0.61		0.22		0.61		0.34		2.35		0.22		0.93		0.38	6.24
10/02/13 P.M.	Sounding (cm)	Before	1	2	3	2	2	2	3	4	2	1	100	5	3	4	45	6	3	1
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.06		0.10		0.08		0.14		0.06		2.13		0.14		1.03		0.08	3.83
11/02/13 A.M.	Sounding (cm)	Before	8	7	15	13	2	14	10	33	9	11	100	15	7	10	43	29	10	11
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.30		0.57		0.32		0.87		0.40		2.33		0.34		1.46		0.43	7.02
11/02/13 P.M.	Sounding (cm)	Before	2	1	2	2	1	1	2	3	2	2	100	4	2	1	39	5	2	3
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.06		0.08		0.04		0.10		0.08		2.11		0.06		0.89		0.10	3.52
12/02/13 A.M.	Sounding (cm)	Before	4	5	21	7	1	6	9	31	15	18	100	17	6	8	40	25	8	10
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.16		0.57		0.14		0.61		0.67		2.37		0.28		1.32		0.36	6.70
13.02.13	Sounding (cm)	Before	3	1	22	7	1	4	8	28	20	17	100	15	7	8	39	29	7	8
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.06		0.59		0.10		0.73		0.75		2.33		0.30		1.38		0.30	5.7
	Sounding (cm)	Before	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Volume pumped out (m^3)		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
Total bilges pumped out (m^3)			3.02		4.82		2.23		6.48		3.46		27.07		2.55		19.25		3.14	
and Total bilges pumped out (m			68.02		139.82		37.23		98.46		81.46		1227.67		81.55		737.25		80.1	

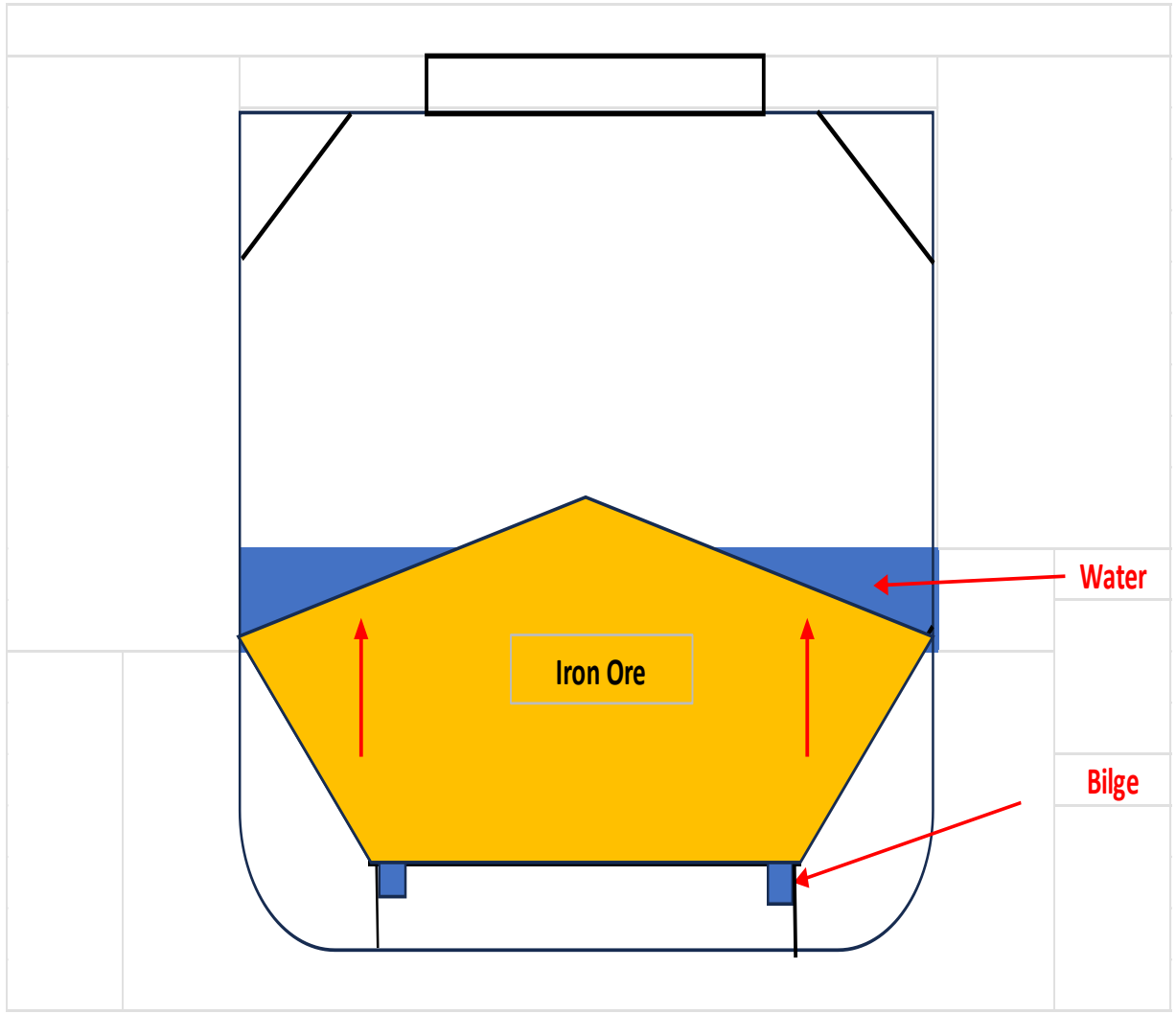
Chief officer Y. Paprotskyy ..... Master Capt. O. Balukhtin .....

Bilge Pumping Log Total Pumped 375 tonnes

Normal procedure for Bulk Carriers is to maintain a daily record of bilge pumping however in the case of Navios Lumen this would give little or no record of the actual condition of the cargo

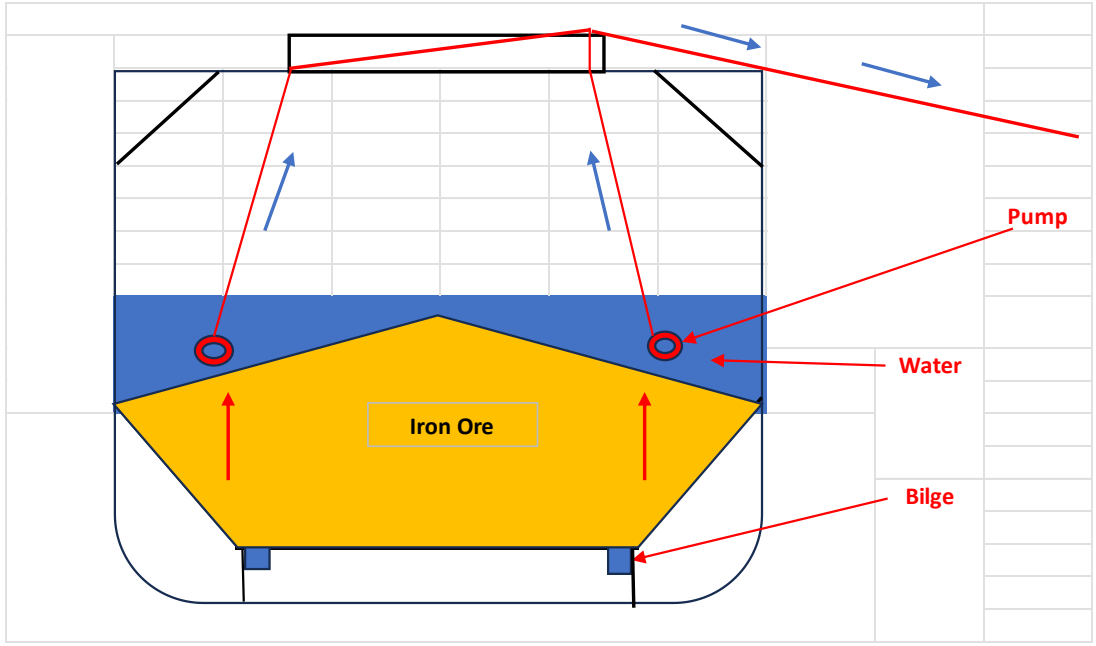
Arrival Condition

Cargo Separation Occurs



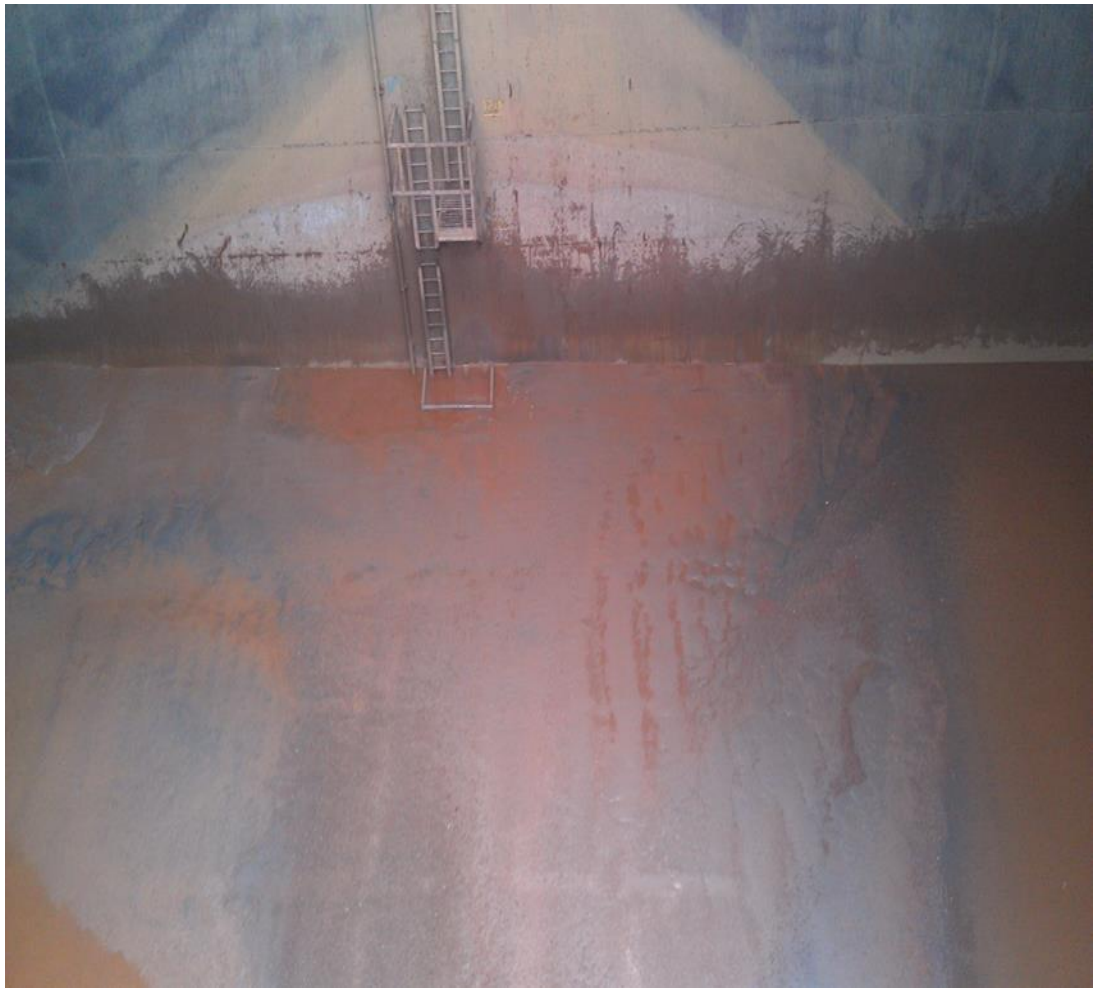
The moisture in the cargo is forced to the surface during sea passage by the much denser ore making bilge pumping ineffective.

Cargo Compaction



In some holds the cargo was levelled and compacted by the surface water movement which was up to 2 metres deep. Submersible pumps had to be deployed to pump out the surface water ashore prior to discharge

Cargo Compaction



Cargo Compaction resulted in slow discharging with poor grab loads and the need to use heavy plant to break up the cargo to facilitate better grabbing.

Effect On Cargo Discharge Operations

- ❑Compacted cargo difficult to grab.
- ❑Reduced grab volume
- ❑Bunker blockages and spillage
- ❑Conveyor overloads and trips.
- ❑Blocked Chutes and shuttles
- ❑Stockpile slippage
- ❑Water disposal
- ❑Environmental Issues

Extended Discharge

NAVIOS LUMEN						
Commenced	16/02/2013	08:05				
Completed	26/10/2023	05:00				
			Actual			
Hours	**From**	**To**	**Tonnes**			
21.9	08:05 / 16th	06:00 / 17th	19,800			
24	06:00 / 17th	06:00 / 18th	18,200			
24	06:00 / 18th	06:00 / 19th	12,400			
24	06:00 / 19th	06:00 / 20th	6,300			
24	06:00 / 20th	06:00 / 21st	8,162	**10 Days**		
24	06:00 / 21st	06:00 / 22nd	13,638			
24	06:00 / 22nd	06:00 / 23rd	17,500			
24	06:00 / 23rd	06:00 / 24th	18,600			
24	06:00 / 24th	06:00 / 25th	24,400			
23	06:00 / 25th	05:00 / 26th	23,235			
236.9			162,235	684.8	tph	Actual
109.25	Expected Discharge Time In Hours			1,485.0	tph	Terminal Average
127.65	Additional Hours Required For Discharge					

- Expected Discharge Time in Hours 109.25
- Actual Hours 236.9 Hours
- **Additional Hours 127.6**

It Is Not An Uncommon Problem

Over a 5 Year period almost 15% of Ore Cargoes from Brazil that discharged at Redcar arrived in a wet and sticky condition which equates to over 3.5 million tonnes all of which led to;

- ❑ Reduced Productivity
- ❑Increased Berth Occupancy
- ❑Poor Vessel Dispatch
- ❑Increased Risk Of Demurrage claims
- ❑Increased Handling Costs
- ❑Increased Wear and Tare and maintenance costs on assets.
- ❑Environmental issues with water disposal.

Wet Ore is not the only commodity

Bulk Handling Systems

- Bulk Handling systems tend to be designed to handle bulk cargoes with similar characteristics.
- It is difficult to design a solution to deal with multiple products with widely different properties.
- What is available in the market ?

Discussion

What bulk handing systems are available to minimise the effect ?