
Loss Prevention Bulletin - AVA/2015/0019

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Copper Concentrate Loading in Rain

'What every Master should know'

Applicable to: Bulk Trade

Region: Western Canada / West Coast of USA

Category: Loss Prevention

Background:

The commercial pressure and sheer burden of responsibilities the Master is faced with in day to day ship operations, especially in port is difficult to comprehend and if not properly informed and advised can give rise to incidents in way of potential cargo claims and losses for P&I clubs. Loading of Copper Concentrate in bulk is no different.

In this brief article we will be discussing some of the issues encountered during loading of Copper Concentrate in bulk in rain and wet conditions and the Master's rights & obligations in regards to the safety of the crew, the vessel and its cargo.

What is Copper Concentrate:

Copper ore is first extracted from a mine and after undergoing some major steps in processing and refinement from grinding; crushing to chemical / physical separation, the end product of copper ore is called 'Copper Concentrate'.

Copper Concentrate that is mined in Northern British Columbia is a mineral ore refined in which valuable components have been enriched (such as copper, gold, molybdenum etc.) by eliminating the bulk of waste materials. The physical state of the cargo varies from greenish brown to greyish finely grounded material ranging from slightly moist mass to dry powdery in appearance. Due to the inclusion of valuable components as above Copper Concentrate is considered a 'high-value' cargo.

Loading in Rain:

The West Coast of Canada is known for its unusual meteorological conditions. Generally late October to April is considered the wettest months where it experiences relentless rain due to depressions in the Pacific one after the other. This in turn is bad news for the shippers/charterers due to port congestion, stockpiling of concentrate and fear of losing their market competitiveness edge to other ports.

However, mining for Copper Concentrate is in "open-pit" conditions (i.e. the cargo would already be exposed to rain/ice/snow) and is thus not rain-sensitive. Having said that this does not mean that the loading should go on during periods of continuous rains because this will increase the Moisture Content (MC) which in turn can exceed the Transportable Moisture Limit (TML) and not only that but also due to increased presence of water content in the cargo can give rise to disputes during draft surveys and weight measurements at the load and discharge ports. In order to understand how rain can affect the MC one first needs to determine the limits of MC and TML.

Understanding MC / TML and FMP:

The Canadian Code of Safe Practice for Solid Bulk Cargo and the IMSBC Code (SOLAS 1974 and its Protocols) sets out the internationally agreed provisions for the safe stowage and shipment of solid bulk cargoes, including cargoes that may liquefy. In the Code:

a) **TML** is defined as 90% of the Flow Moisture Point (FMP). Essentially TML represents the maximum moisture content of the cargo which is considered safe for carriage in ships (regulation 1.7.27 of IMSBC Code Ed 2013). TML can be explained as a reference value against which MC is measured. Just like for entering enclosed spaces Oxygen level should be 21% and any value less than this would mean there is a deficiency of Oxygen in that space.

b) **FMP** of any cargo is considered to be the percentage of MC at which the cargo would behave like a fluid and develop a flow state (i.e. liquefying). The FMP depends on the characteristics of cargo; the environment in which it is kept (e.g. stored out in the open exposed to the elements like rain, snow etc.) and should be measured experimentally in a laboratory environment. The bottom line is that any such cargo may liquefy if shipped with MC in excess of their TML. In other words for the cargo to be acceptable for loading the MC should be less than the TML.

Further the Code also states that the shipper must provide the Master with written evidence that the MC does not exceed the TML. This is usually in a form of a certificate/declaration (there is no prescribed format) and the analysis should have been recently done (less than 7 days). As a minimum the certificate of the MC / TML should bear the following:

- Duly signed and dated;
- MC test conducted with the last 7 days from the date of the certificate
- Note TML tests could be valid up to 6 months (see frequency of TML/MC testing Regulation IMSBC Code Reg.4.5.1 /4.5.2)
- Declaration by shipper that the MC is, to the best of his knowledge and belief, the average moisture of the cargo at the time the declaration is presented to the Master.

Failure to provide with such a certificate declaration the Master should not load the cargo and has the right to reject the cargo. Following is an excerpt from the Code of Safe Practice for Solid Bulk Cargo. Section 4.5.1 and 4.5.2 stating that:

4.5.1 - A test to determine the Transportable moisture limit of solid bulk cargoes which may liquefy should be conducted at regular intervals. Even in the case of materials of consistent composition, this test should be conducted at least once every six months. However, where the composition or characteristics are variable for any reason, more frequent testing is necessary. In such cases, testing once every three months and possibly more frequently is essential as such variations could have a

significant effect on the value of the Transportable moisture limit. In certain cases it will be necessary to test every shipment.

4.5.2 - Sampling and testing for Moisture content should be conducted as near as possible to the time of loading. In any event the time interval between sampling/testing and loading should never be more than seven days unless the consignment is adequately protected to ensure that no change occurs in its moisture content. Furthermore, whenever there has been significant rain or snow between the time of testing and loading, check tests should be conducted to ensure that the cargo is still in a safe state to load.

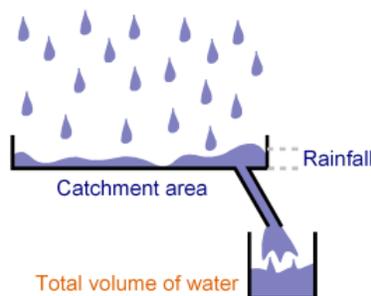
How much Rain is too much:

The key issue is whether the solid bulk cargo that is to be loaded, in this case Copper Concentrate, is liable to liquefaction? The cargo may appear to be relatively dry when loaded; however, it may still contain sufficient moisture to become fluid under the stimulus of the compaction and vibration that occurs during a voyage (caused by recurring cycles or cyclic forces, such as the movement of the ship and rolling/pitching/pounding etc.) resulting in a potential loss of the ship's positive stability from a reduction in metacentric height (GM). The effect on a ship can be sudden and dramatic causing the vessel to capsize! So how much rain is too much? Rainfall is classified according to the rate of precipitation (rain intensity) as follows:

<u>Category</u>	<u>Rate (mm/hour)</u>
Light Rain	< 1.0
Moderate	1.0 ~ 4.0
Heavy	4 ~ 16
Very Heavy	16 ~ 50
Extreme	> 50

Estimating the amount of water entering the cargo hold can be calculated as follows: For an open hatchway (consider this as a catchment area) measuring 18.5 m x 17.9 m with 10 mm of rainfall the amount of water entering the cargo hold would be 3.31 m³ (3310 litres) every hour (it is not uncommon for Vancouver, especially North Vancouver where the loading facility is located to experience extremely heavy rains in winter months)

“Rule of the thumb is to remember that one millimetre (mm) of rain falling on one square metre produces one litre of water”



Volume of Rainfall per Hour (in litres) = Precipitation Rate per hour (mm) X Area (m²)

Volume of Rainfall per Hour (in m³) = $\frac{\text{Precipitation Rate per hour (mm)} \times \text{Area (m}^2\text{)}}{1000}$

The decision to load during rain will depend on the rain category (i.e. light, medium, heavy etc.) and also the safety margin - difference between the given MC for the cargo and the TML, the bigger the difference the better the safety margin.

So how does one determine how much rain is too much? It seems that we need to develop a better understanding of the degree of risk that this cargo presents. By following this simple calculation the Master can determine whether continuous loading in rain will cause the MC to exceed TML limits.

Working example to determine if MC will exceed TML:

a) Cargo Nomination (Copper Concentrate in Bulk)	5000.00	mt
b) Loading Cargo Hold(s)	No 5 Hold	
c) Open Hatchway Area per cargo hold (18.5 m X 17.9 m)	331.15	m ²
d) Cargo MC (determined within last 7 days)	7.78	%
e) Cargo TML (determined within last 6 months) - TML is 90% of FMP	9.19	%
f) FMP	10.21	%
g) Safety margin (difference between given MC & TML)	1.41	%
h) Moisture (rain) required to bring current MC up to TML	140.90	m ³
i) Precipitation Rate per Hour (as an example)	20.00	mm
j) Volume of Rainfall per hour added to the cargo (if loading in rain continues)	6.62	m ³
k) Time it will take for MC to equal the TML	21.27	hours

From the above it is clear that if loading is continued for over 21 hours the MC will exceed TML for this particular parcel and the Master would be in contravention of the IMSBC Code. The above is just an example as for a full load of Copper Concentrate cargo, one would need a lot of rain to cause the MC to increase sufficiently to exceed the TML.

“You would need a lot of rain to cause the MC to increase sufficiently to exceed the TML”

Having said that considering the unusual climate of the West Coast loading in heavy rains is not prudent and if in any doubts the Master should contact its P&I Club for advice. Loading high value cargoes such as Copper Concentrate in rain can bring about other problems as discussed below:

Issues relating to weigh measurement at loading port:

We are seeing lot of issues related to final weight measurements between the ship and shore figures (determined via draft surveys and government certified belt scales) leading to heated disputes between the Owners and the shippers/charterers, often requiring intervention by P&I Club. Despite best efforts sometimes significant difference remains.

Taking our example above loading in rain for 21 hours, the cargo hold now has an added weight of 141 mt which nobody seems to have taken into account during draft survey calculations nor the shipper's acknowledging the fact that their cargo now contains an excessive amount of moisture than what was originally declared on the Moisture Certificate. However, despite these inconsistencies the Master would have been instructed or rather pressured by the shippers that no remarks shall be allowed to put on the Mate's Receipt.

We would strongly advised against this practice as by signing incorrectly claused M/R or B/L where the figures are factually incorrect could jeopardize the P&I cover. If the Master is uncertain he should insist on putting his own remarks such as "weight, measure, quality, condition, contents and value unknown and "weight determined by draft survey only or belt scale only where appropriate". If in doubt always seek assistance from P&I Club.

Issues relating to weigh measurements (in-transit losses) at discharge port:

Copper Concentrate ore if shipped with high moisture content (MC) will cause concentrate loss of the net invoice value. For example a cargo of 10,000 mt of Copper Concentrate with 5% MC essentially contains 500 mt of water. Depending on the agreement and clauses in the c/p, the receiver at the discharge port can claim for this loss. To mitigate 'in-transit' losses it would be prudent to sound the hold bilges daily or as necessary during the ocean voyage and keep a record of accumulated water being pumped out in the deck logbook to justify any claims of shortage at the discharge port.

Owners / Master's Rights:

The stevedores may try to intimidate the Master that if the loading is not continued in rain any delays caused will be for the ship owner's account and so called 'rain letters' by charterers claiming to provide indemnity to the vessel against any losses for loading in rain should not be accepted as accepting the rain letter may jeopardize the P&I cover as a result of the member knowingly carrying out loading operations where the risk of cargo claim existed. (Note: A member's P&I insurance is subject to the warranties, conditions exceptions, limitations and other terms set out in the rules and the Certificate of Entry)

The following is an excerpt for an actual c/p and it would be prudent that these clauses are incorporated in all charter parties especially vessel's engaged in bulk trades where cargo is likely to liquefy.

(a) All cargoes to strictly comply with latest IMO and SOLAS regulations and the IMSBC 2009 code and any subsequent new edition thereof or amendments thereto and local regulations. Charterers/Shippers and their agents to ensure and fully comply with latest applicable IMO regulations inclusive of the latest SOLAS regulations and IMSBC 2009 Code (and any subsequent new edition thereof or amendments thereto) and local regulations for all cargoes to be loaded, carried and discharged. Failure to satisfy/comply with the above provisions/requirements will entitle the Master to withhold the commencement or continuation of loading or discharging.

(b) Charterers to keep vessel in a seaworthy trim condition, to Master's satisfaction, during her sailing and/or shifting between all berth and ports. BIMCO Solid Bulk Cargoes that Can Liquefy Clause for Charter Parties shall apply to all relevant cargoes loaded.

(c) The Charterers shall ensure that all solid bulk cargoes to be carried under this Charter Party are presented for carriage and loaded always in compliance with applicable international regulations, including the International Maritime Solid Bulk Cargoes (IMSBC) Code 2009 (as may be amended from time to time and including any recommendations approved and agreed by the IMO).

(d) If the cargo is a solid bulk cargo that may liquefy, the Charterers shall prior to the commencement of loading provide the ship's Master, or his representative, with all information and documentation in accordance with the IMSBC Code, including but not limited to a certificate of the Transportable Moisture Limit (TML), and a certificate or declaration of the moisture content, both signed by the shipper”

(d) The Owners shall have the right to take samples of cargo prior to loading and, at Charterers' request, samples to be taken jointly, testing of such cargo samples shall be conducted jointly between Charterers and Owners by an independent laboratory that is to be mutually agreed by Owners and Charterers. Sampling and testing shall be at the Charterers' risk, cost, expense and time. The Master or Owners' representative shall at all times be permitted unrestricted and unimpeded access to cargo for sampling and testing purposes. If the Master, in his sole discretion using reasonable judgment, considers there is a risk arising out of or in connection with the cargo (including but not limited to the risk of liquefaction) which could jeopardize the safety of the crew, the vessel or the cargo on the voyage, he shall have the right to refuse to accept the cargo or, if already loaded, refuse to sail from the loading port or place. The Master shall have the right to require the Charterers to make safe the cargo prior to loading or, if already loaded, to offload the cargo and replace it with a cargo acceptable to the Master, all at the Charterers' risk, cost, expense and time. The exercise by the Master of the aforesaid rights shall not be a breach of this Charter Party.

(f) Notwithstanding anything else contained in this Charter Party, all loss, damage, delay, expenses, costs and liabilities whatsoever arising out of or related to complying with, or resulting from failure to comply with, such regulations or with Charterers' obligations hereunder shall be for the Charterers' account. The Charterers shall indemnify the Owners against any and all claims whatsoever against the Owners arising out of the Owners complying with the Charterers' instructions to load the agreed cargo.

(g) This Clause shall be without prejudice to the Charterers' obligations under this Charter Party to provide a safe cargo. In relation to loading, anything done or not done by the Master or the Owners in compliance with this Clause shall not amount to a waiver of any rights of the Owners”

Disclaimer: This loss prevention bulletin is based on the author's own research, knowledge and experience in the subject matter and should only be used for reference rather than being taken as a legal advice for any particular case or used for any other purpose.

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