1 April 2016

Mr Reuben McGovern
Case Manager
Anti-Dumping Commission
Level 35
55 Collins Street
MELBOURNE VICTORIA 3000

Public File

Dear Mr McGovern

Investigation No. 316 – Grinding Balls exported from P R China

Introduction

I refer to the submission made on behalf of Changshu Longte Grinding Ball Co., Ltd (“Longte”) in relation to Issues Paper No. 2016/01. Their submission has raised a number of concerns that Commonwealth Steel Company Pty Ltd (“Moly-Cop”), as a member of the Australian industry would like to comment upon.

Raw material input at less than adequate remuneration

It is submitted on behalf of Longte that it has not received any “billet” at less than adequate remuneration (“LTAR”) during the investigation period. Longte confirmed that it purchased grinding bar as a raw material input for the manufacture of grinding balls and refers to “Exhibit G-6.1” for its list of grinding bar suppliers, including related party supplier Longteng, during the investigation period.

It is argued by Longte’s representative that neither Longte nor Longteng received billet at LTAR. However, Moly-Cop submits that the purchase price paid for the grinding bar by Longte from Longteng (or indeed other Chinese grinding bar suppliers) is at a price influenced by government of China (“GOC”) market-affected distortions that have resulted in artificially low prices for the key raw materials and other inputs associated with the production of the steel billets from which the grinding bar is produced.

It is noted that the Longte submission states that Longteng purchases coke and coal for the manufacture of grinding bar “on the open market in China”. It is also stated by Longte that it has not purchased coke or coal from the GOC or a ‘public body’. Moly-Cop submits that the Chinese coke and coal markets are dominated by government bodies and that the prevailing domestic selling prices – including selling prices by private companies in China – are similarly influenced by the government bodies involved in the sale of both products domestically in China.

The Anti-Dumping Commission (“the Commission”) has previously determined (Report Nos. 177, 190, 193, 198 and Statement of Essential Facts (SEF) Nos. 300 and 301) that raw material steel input prices (i.e. billet and HRC) are artificially low due to the government policies that impact domestic prices for coke and coal. The same GOC policies impact domestic coke and coal prices in China used in the production and manufacture of billet produced and rolled to grinding bar consumed in grinding ball manufacture.

In SEF No. 300 - published recently for steel reinforcing bar (“rebar”) exported from China - the Commission made the following statement in relation to determining the most appropriate approach for finding benchmarks for competitive market costs:

“the influence of the GOC is wide ranging and reducing the influence of GOC only to input raw materials does not reflect the amount of distortion which includes GOC influence on the costs of converting raw materials to billet”
Moly-Cop maintains the view that the domestic selling prices for the raw material inputs (billet rolled to grinding bar) used in the manufacture of grinding balls are subject to the wide-ranging influences of the GOC and are artificially low. It is therefore necessary to substitute a (non-China influenced) market price for billet with the necessary alloy additions required to produce the grinding bar chemistry specific to Longte to enable the determination of normal values for grinding balls for Longte.

Market Situation for grinding balls in China

Moly-Cop agrees with Longte that the Commission is required to examine whether a particular market situation applies in respect of grinding balls sold on the Chinese domestic market. It is noted that in relation to the Commission’s recent market situation finding for rebar exported from China outlined in SEF No. 300 that:

“The Commission has formed the view that the GOC influence in the iron and steel industry is most pronounced in the parts of that industry that might be described as upstream from rebar production. In particular, GOC-driven market distortions have resulted in artificially low prices for the key raw materials, and this includes the other inputs associated with the production of the steel billets.”

and

“The Commission also considers that various plans, policies and taxation regimes have also distorted the prices of production inputs including (but not limited to) raw materials used to make steel in China, rendering them unsuitable for cost to make and sell (CTMS) calculations.” [emphasis added]

It is Moly-Cop’s view that these statements are equally relevant for grinding balls produced via a billet-to-grinding bar input feed as they are for other billet derived products such as rebar and rod in coils.

Moly-Cop would also like to point out that these views are supported by steel industry associations in other jurisdictions. For example, in Appendix 1 to SEF No. 300, the Commission referenced the following commentary on the 2015 revision of China’s Steel Industry Adjustment Policy:

“Following the release of China’s revised steel industry adjustment policy, a group of eight steel industry associations of North America, Latin America, and Europe issued a joint statement dated 20 April 2015 voicing their concerns about the approach of the Chinese government in achieving its policy objectives. In the conclusion of this joint statement, these industry associations state that:”

“… we believe that the Policy does not introduce market-oriented reforms that are sufficient to achieve these goals and will therefore not adequately address the significant problems facing the Chinese steel industry. Unfortunately, the Adjustment Policy continues to reflect a top-down, state dominated approach to reforming the steel industry – thereby maintaining an environment where market forces do not apply. In our view, the only way to achieve the Policy’s stated objectives are to eliminate government interference in the industry and allow basic market forces to dictate industry outcomes.” [emphasis added]

Appropriate benchmark

Moly-Cop agrees with Longte that the cost that the Commission “might seek to benchmark” would be the cost of grinding bar and recognizes that there is no published “grinding bar” price available from any of the notable steel industry publications. It is therefore necessary for the Commission to construct a grinding bar price to be used as the benchmark in Longte’s production costs for grinding balls.

As proposed in Moly-Cop’s response to Issues Paper 2016/01, this can be achieved via selection of:

(a) an appropriate (commercial grade) non-China influenced billet benchmark; and

(b) adjustments applied for alloy additions required to produce the required grinding bar chemistry required for grinding ball production.

Longte’s suggestion that - in the absence of a benchmark for grinding bar, the Commission use Longteng’s production cost of grinding bars, in its integrated plant, in the second half of the investigation period as the “benchmark” cost of grinding bar in the cost calculation for Longte for the entire investigation period – is clearly unacceptable and would (even if the market situation concerns were temporarily suspended) point to an unashamed attempt by the exporter to induce the Commission to disregard the influence of raw material and alloy price changes across the entire investigation period. For hopefully obvious reasons, Longte’s proposal here should be wholly disregarded by the Commission.

The exporter further states:

“Longte is the only grinding ball manufacturer in the world that has a fully integrated production line. The huge production and volumes provides a very beneficial scale effect at both steel making and round bar rolling. This lowers Longte’s costs in comparison to its other steel mill competitors.”

Yet the only evidence Longte submits in support of this claim of lower “costs in comparison to… other steel mill competitors” is a flowchart and description of Longteng’s “state of the art steel-making”. Apart from not passing even the lowest evidentiary thresholds, the danger in Longte’s unsubstantiated claims of lower conversion costs is the risk it poses to the Commission’s assessment of a constructed normal value for Longte. Therefore, great care must be taken by the Commission when assessing Longte’s fixed overhead and non-material variable costs.

Moly-Cop further notes that there is no evidence submitted by Longte to substantiate its claim that the redacted (assumed to be degassing facilities run by Longte) have:

“running costs which are roughly [CONFIDENTIAL TEXT DELETED – number] % lower than other steel mills who are mainly running RH facilities”.

Moly-Cop urges the Commission to exercise caution in accepting these unsubstantiated claims made by Longte. By way of evidence, in the 2014 presentation “Vacuum Treatment of Molten Steel: RH (Rurhstahl Heraeus) versus VTD (Vacuum Tank Degasser)” delivered at the SEAISI Conference, the following statements are made:

“The selection of RH or VTD is strictly dictated by steel grades to be produced. In most cases, the installation of RH vacuum degassing is more dominant, especially for big heat size,


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compared to VTD due to its excellent mixing performance, short cycle time for
decarburization and degassing which results a great number of heat can be treated per day."

In relation to the removal of hydrogen (the key requirement in grinding ball production):

"The performance of hydrogen removal is more or less similar between RH and VTD."

In other words, RH degassing remains a viable, “dominant” option providing numerous efficiency
benefits for steelmakers. The attempts by Longte’s consultant to establish RH degassing as a costly,
outdated technology (“developed in the 1950s”) is simply misinformed. As discussed in NON-
CONFIDENTIAL ATTACHMENT A, a number of vacuum degassing techniques were developed since
the 1950’s and the two most prevalent remaining today (which have no doubt undergone efficiency
improvements since the 1950s) are RH and VTD:

“Since 1950s, vacuum techniques were developed for degassing purposes. These techniques
include DH (Dormund Hoerder) degassing, RH (Rurhstahl Heraeus) degassing, Vacuum
Tank Degassing (VTD), Vacuum Arc Degassing (VAD), and Vacuum Induction Melting
(VIM). Nowadays, there are two techniques commonly used for mass production of steel in
order to reduce gases and carbon contents namely RH and VTD.”

In yet another example of confused reasoning, the exporter makes the statement:

"Longte cannot see evidence of an untoward situation in the Chinese market for grinding balls
that would disqualify its domestic prices from comparison with its export prices"

Longte then goes on to say:

"Longte’s products are specially designed to suit higher-end export markets. This requires
customized grinding bar supply for the making of grinding ball products not commonly used in
the Chinese domestic market."

Given the numerous unsubstantiated and conflicting claims contained in the Longte submission, Moly-
Cop urges the Commission to reject the information submitted by Longte as unreliable, and instead
substitute competitive market input costs independent of data provided by Longte for grinding ball
feed material inputs.

Published steel billet data

Moly-Cop refers to the submissions of the Australian industry in response to SEF Nos. 300 and 301
filed on 29 February 2016 and 10 March 2016, respectively.

In those two submissions the Australian industry, advocated for the use of domestic billet price
information as a benchmark for competitive market costs for billet. In so doing, the Australian industry
referred to monthly domestic billet price data published by MEPS (International) Ltd (“MEPS”).

For completeness, I therefore attach a reproduction of a subscription to MEPS Semi-Finished Steel
Review for the period August 2014 to October 2015 (CONFIDENTIAL ATTACHMENT A refers)
obtained by Moly-Cop’s parent company3. Moly-Cop has also obtained the express written
permission from the publisher of the data, reproduced at CONFIDENTIAL ATTACHMENT B.

MEPS – “a reputable provider of steel price data”

In its submission dated 18 February 2016, Longte made a number of inflammatory and
unsubstantiated attacks against the use of MEPS data as an appropriate benchmark steel billet price.

3 Commonwealth Steel Company Pty Ltd (trading as Moly-Cop) is a wholly owned subsidiary of Arrium Ltd.
These confected criticisms were clearly at odds with the international anti-dumping community's high regard for the quality and impartiality of MEPS data, including, but not limited to the Commission.

In Review of Measures No. 285, the Commission formed the following view of MEPS and its published data:

“The Commission advises indexing was sourced from MEPS (International) Ltd (MEPS), a reputable provider of steel price data. The Commission has purchased this data under subscription from MEPS, for use in Review 285.”

MEPS data is also regularly referenced by other anti-dumping administrations. For example, the Canada Border Services Agency in its Statement of Reasons concerning the initiation of an investigation into the dumping of certain hot-rolled carbon steel plate and high-strength low-alloy steel plate originating in or exported from the Federative Republic of Brazil et Ors, considered MEPS data as:

“Both MEPS and CRU are reputable independent firms which publish statistical data, market trends, activity forecasts and market research on world commodities. In addition, information from these sources is provided in sufficient detail to allow a proper product comparison with plate imported into Canada.”

Similarly, the Canadian International Trade Tribunal (CITT) noted the role of MEPS as an acceptable source of international steel price data:

“The Tribunal considers that, for the purposes of this expiry review, established steel industry publications are the most reliable references for global and specific country steel prices and forecasts, and notes that each of the parties referenced such publications as CRU’s Steel Sheet Products Monitor, CRU’s Steel Sheet Quarterly, Barnes’s U.S. Industry and Market Outlook, MEPS’s International Steel Review, Metal Bulletin Research reports and World Steel Dynamics reports for the purposes of corroborating the statements of their respective witnesses…”

Again, in 2014, the New Zealand administration used MEPS data to construct normal values in its 2014 sunset review into the anti-dumping duties applying to galvanised wire from Malaysia.

Indeed, MEPS steel price data is also endorsed on the Australian Steel Association’s (ASA) website. This is significant, as the ASA is the peak membership association for steel trading companies and stockists/distributors of imported steel products.

Therefore, the Commission should have no doubt that MEPS is a reliable, reputable and internationally regarded supplier of objective steel price data, regularly used by leading, WTO compliant anti-dumping administrations.

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4 EPR Folio 285/022 at p. 2.
5 Canada Border Services Agency, Statement of Reasons concerning the initiation of an investigation into the dumping of certain hot-rolled carbon steel plate and high-strength low-alloy steel plate originating in or exported from the Federative Republic of Brazil Chinese Taipei, the Kingdom of Denmark, the Republic of Indonesia, the Italian Republic, Japan, and the Republic of Korea, 4214-41 AD/1402, OTTAWA, September 20, 2013.
6 Ibid., at p.12.
7 Canadian International Trade Tribunal, Orders and Reasons: Expiry Review No. RR-2010-001 concerning the dumping of flat hot-rolled carbon and alloy steel sheet and strip originating in or exported from Brazil, the People’s Republic of China, Chinese Taipei, India and Ukraine and the subsidizing of flat hot-rolled carbon and alloy steel sheet and strip originating in or exported from India, August 15, 2011 at p. 16.
8 Ministry of Business, Innovation and Employment
MEPS publishes monthly domestic EXW billet prices, denominated in US$/tonne for standard commercial quality steel billet for a number of domestic markets. Moly-Cop considers the use of other country domestic price information as a suitable external benchmark which is consistent with the principle of trying to achieve parity between the market conditions for the supply of goods to the producer in the country of export, with the other, benchmark country. This cannot be achieved via an export price benchmark that reflects marginal pricing and does not necessarily reflect the full cost of all inputs. The Commission is cautioned against using an export price benchmark that reflects marginal pricing principles.

When selecting an appropriate domestic market benchmark the Commission should have regard to the volume of Chinese steel billet exported into those domestic markets. A recent report published by Wood MacKenzie indicates that Chinese steel billet is exported into neighbouring Asian and Middle-Eastern markets as ‘square bar’:

“Chinese exports: what and where to?
“Chinese steel exports are quite well spread around the world, although naturally China’s neighbouring countries including South Korea and Southeast Asia take approximately half the total volume. Exports to the EU and the US combined accounted for just 10% of total exports in 2015.

…
“Product wise, flat products and long products accounted for nearly 90% of total exports, with the rest being tubes and other products. It is worth highlighting that since late 2014, Chinese steel mills have been exporting billet (semi-finished steel) under the HS code of alloyed square bar (finished steel) in order to avoid paying export tax on semi-finished steel and to claim VAT refund. We estimate that out of ~50M[llion] t[onnen] of longs exports, around 18M[llion] t[onnen] were actually exports of billet which were mainly destined for Southeast Asia and Middle East. This had some big implications on those markets where some steel mills have been cutting melting output and re-rolling imported billet instead.”

The impact of this practice of exporting alloyed square bar as a means of competing with neighbouring regional domestic billet markets was recently expressed as follows:

“During January, Taiwan imported 158,000 mt [metric tonnes] of China-origin billet – a large volume – at an average price equivalent to TWD 8,700/mt. Much of the billet was delivered to re-rollers in Tainan, thus making the latter very competitive in rebar sales, the Feng Hsin [Feng Hsin Iron & Steel] official added. The rolling cost for converting billet to rebar in Taiwan is usually no more than TWD 1,500/mt, according to Taiwan market sources.”

Therefore, in selecting an appropriate competitive domestic benchmark market, regard should be had to the degree of penetration of the domestic market by Chinese steel billet, traded as alloyed square bar. According to the research of Wood Mackenzie cited above, South Korean, Southeast Asian and Middle Eastern Markets should be avoided as representative of competitive markets not affected by Chinese prices. Wood Mackenzie’s conclusions are represented graphically below:

[The following graphic is CONFIDENTIAL for licensing and copyright reasons]

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12 SBB Daily Briefing - 23 Feb 2016, ‘Taiwan's Feng Hsin cuts rebar prices to combat Tainan rivals’. Reproduced as CONFIDENTIAL ATTACHMENT D.
In summary, Moly-Cop submits that a competitive cost benchmark should be selected by reference to domestic markets with limited exposure to Chinese alloyed square bar exports. Therefore, regard should be made to United States, European Union or African (in particular South African) domestic billet prices.

Adjustment for alloy additions to ensure actual costs captured for billet suitable for grinding bar production

Further, this submission seeks to assist the Commission to develop a methodology to calculate the alloying costs applicable to grinding bar grades used in the manufacture of grinding balls. Moly-Cop, as an integrated Australian producer of grinding balls, with experience in steelmaking, grinding bar rolling and grinding ball production, is well-placed to assist in this area. Moly-Cop also proffers independent sources of ferro-alloy pricing for consideration by the Commission.

Specific grinding bar grade chemistries are often custom-developed by grinding ball producers with their mining customers for use in a specific mill arrangement. Grade development or "optimisation of steel grades" is a key part of the technical assistance offered by Moly-Cop to customers as reflected on the website\textsuperscript{13}.

Given that costly ferro-alloy additions (such as ferro-chromium) are often required, it is essential that steelmakers involved in grinding bar production are able to accurately predict the final chemistry for a

\textsuperscript{13} \url{https://www.arrium.com/our-businesses/arrium-mining-consumables/moly-cop/grinding-media/australia/grinding-balls}
heat (batch) of steel based on specific amounts of ferro-alloy additions. In order to ensure that ferro-
alloy additions are made as efficiently and cost-effectively as possible, the metallurgical steelmaking
specialists involved in grade development typically have a metallurgical (mass-balance) model which
they have fine-tuned via multiple iterations. Moly-Cop has developed their own model which takes
into account the following:

• Purity of ferro-alloys – eg. different types of ferro-manganese will have different percentages
  of manganese present.

• Recovery of ferro-alloys – some ferro-alloy additions will give a higher recovery (or yield) in
  the steel compared to others, based on the type (varying levels of reactivity, fine versus
  coarse etc).

• Multiple ferro-alloys can contribute a specific element to the steel – eg. adding ferro-silicon,
  ferro-manganese and silico-manganese can all contribute silicon and manganese to the steel
  batch being produced.

• Typical baseline/residual furnace chemistry – whether produced via EAF or BF/BOF, there
  will always be (minor) amounts of elements such as carbon, silicon and manganese present
  in the steel prior to specific targeted ferro-alloy additions being made.

For the purpose of providing the Commission with an informed, reasonable method of determining
alloying costs for steel used for grinding bar relative to the alloying costs required to produce a
commercial grade billet chemistry, Moly-Cop has developed a spreadsheet (refer CONFIDENTIAL
ATTACHMENT E) based on the model described above. In each of the grade alloy cost scenarios
presented, the ferro-alloy costs to produce a grade Q235 commercial grade steel have been
compared to the ferro-alloy costs to produce a grade of steel typically used to produce the range of
sizes and chemistries of forged grinding balls. Some of the chemistries presented reflect testing
conducted by Moly-Cop on actual China-produced forged grinding balls.

The types of ferro-alloys used by Moly-Cop have been specified together with the FY16 budgeted
cost in AU$/t applicable for each ferro-alloy. This has been done for simplicity, to demonstrate the
difference in costs when a grinding bar grade is produced compared to a commercial grade using the
same types of ferro-alloys of a given price. The cost of ferro-alloying for Moly-Cop across the range
of grinding ball sizes and commonly produced grades over the investigation period has been the
subject of verification and in the absence of any other reliable data may provide some guidance to the
Commission.

Alternative ferro-alloy pricing

In order to provide the Commission with alternative (non Moly-Cop specific) ferro-alloy pricing for
consideration, Moly-Cop submits monthly ferro-alloy pricing for comparable ferro-alloy compositions
supplied into a number of markets over the period October 2014 to September 2015 as supplied by a
reputable independent source, namely XXXXXXXXXXXXXXxxxX (refer CONFIDENTIAL
ATTACHMENT E tab “Ferroalloys”). It is Moly-Cop’s recommendation that non-China ferro-alloy
prices be selected where possible. This view is based on the findings by the Canadian Border
Services Agency (“CBSA”) in its Statement of Reasons for the investigation of silicon metal exported
from China dated 5 November 2013, where it established:

“The wide range, length and the material nature of the GOC measures above have resulted in
significant influence on the Chinese ferroalloy sector [emphasis added], which includes silicon
metal.”

http://www.cbsa-asfc.gc.ca/sima-lmsi/i-e/ad1400/ad1400-i13-fd-eng.html

Refer Paragraph [141]
Proposed form of measures

Moly-Cop observes that since approximately late-2013, the Commission has generally recommended that interim dumping duties (“IDD”) be calculated using the ad valorem duty method at the level of the full dumping margins calculated.

Moly-Cop notes that the Commissioner is free to recommend to the Assistant Minister, within the limits prescribed by the Customs Tariff (Anti-Dumping) Regulation 2013 (“the Dumping Duty Act”), the different types of duty. There is nothing in the WTO Anti-Dumping Agreement that explicitly identifies the form that the IDD must take, and there is nothing that explicitly prohibits the use of variable anti-dumping duties.

The Australian industry submitted at the verification visit that the Commission should apply the combination of fixed and variable duty method. Moly-Cop now points to the following facts verified in the course of the investigation that support the calculation of interim dumping duties using this method:

(a) there are exceedingly complex company structures with related parties in the case of verified exporters – with particular concerns relevant to the accuracy of the information of exporters’ related trading entities;

(b) there is a real advantage to downstream users in setting the IDD by reference to a minimum price (the variable component) in that it tends to stabilise prices quickly following the publication of the Dumping Duty Notice at the levels required to eliminate dumping and material injury to the Australian industry. The fixed and variable method of IDD calculation provides certainty to market participants when factoring in price revisions to the Australian market both in the short and medium terms. Indeed, the European Commission recently recognised this advantage in European Union - Definitive anti-dumping duty on imports of certain grain-oriented flat-rolled products of silicon-electrical steel originating in the People’s Republic of China et Ors:

“…On the basis of the specific facts of the case, the Commission considered that a variable duty under the form of a minimum import price (MIP) duty would be the most appropriate form of measures in this case. On the one hand, such MIP would allow the Union producers to recover from the effects of injurious dumping. It would be a safety net to enable them to return to a sustainable profitability and incentivise them to make the necessary investments to produce proportionally more of the high-permeability product types of the like product. On the other hand, such MIP should also prevent any adverse effect of undue price increases after the investigation period which could have a significant negative impact on the users’ business…”

Indeed, from the downstream users’ perspective, as the goods are a commodity product, undumped goods from non-subject sources are available via established distribution channels. Therefore, it cannot be argued that the imposition of measures (whether calculated by the combination method, or otherwise) are punitive to downstream users. In fact, because the combination method achieves greater stabilisation of market prices following the imposition of measures, the impact is less “punitive” (if at all) on downstream users via the combination method.

(c) although the “effective rate of duty” will fluctuate as the actual/dumping export price changes over time following implementation of measures, the ad valorem method cannot guarantee the effectiveness of the implemented measures in a falling market. This is because under a final duty assessment, the total unpaid duty in excess of the interim duty already paid must be


waived.\textsuperscript{17} As such, the \textit{ad valorem} method is punitive to the Australian industry, as the measures have failed (to borrow from the language of the European Commission referred to above), “\textit{to allow the [Australian] producers to recover from the effects of injurious dumping}”\textsuperscript{18}. On the other hand, the combination method of IDD calculation ensures that the measures are fully and effectively administered, with no risk of under-collection of IDD at the time of final duty assessment. The suggestion that the combination method has the risk of being punitive to the importer, ignores the role of the final duty assessment process, which ensures that that the total interim duty overpaid in respect of all consignments to which the duty assessment relates, is repaid. Therefore, whereas the combination method cannot be punitive to either the Australian industry or importers, the \textit{ad valorem} method can be punitive to the Australian industry in a falling market. This issue is explored further below.

(d) given that there is no capacity to collect a short-fall in the effective rate of duty – thereby compounding injury to the Australian industry, and rendering the imposition of the duties ineffective – the fixed and variable method of calculating IDD ensures that there is symmetry within the administration between the economic interests of the domestic industry and exporters/importers of dumped goods; and

(e) should the ascertained export price (“AEP”), comprising the variable component of the IDD calculation model, become out-of-date, exporter/importer interests or the Australian Industry may apply for a variable factors review to address the medium-term impacts (noting that importers have the option of applying for final duty assessments to address undumped transactions in the short-term, something that is not open to the Australian industry where insufficient duty has been collected).

Moly-Cop notes the Commission’s \textit{Guidelines on the Application of Forms of Dumping Duty} (November 2013) observes that a potential disadvantage of the \textit{ad valorem} duty method is:

“export prices might be lowered to avoid the effects of this duty”\textsuperscript{19}

Moly-Cop submits that this risk is particularly amplified in the case of a particular market situation finding, where the producer/exporter’s variable material costs are not reflective of competitive market conditions and the capacity to drive down price to maintain market share is not confined by the commercial realities of market prices for input costs. Although Moly-Cop observes some commentary that this may constitute a circumvention activity, we do not consider it good policy for the Commission to knowingly apply ineffective measures with a caveat that a hitherto, materially injured Australian industry can separately, and at its own expense make application for redress. The asymmetrical burden placed on the Australian industry in such circumstances is further compounded by the timeframes for making such application for redress under the domestic legislation.

Given the propensity of the verified exporters to lower the export price, the impact on the effectiveness of such action under the \textit{ad valorem} method is demonstrated via the following model:

\textsuperscript{17} Subsection 269Y(1), \textit{Customs Act 1901}\textsuperscript{18} Refer fn 32.\textsuperscript{19} Anti-Dumping Commission, \textit{Guidelines on the Application of Forms of Dumping Duty} (November 2013) at p. 11.
Clearly, the combination method achieves the most effective outcomes from the anti-dumping system, scoring perfect alignment between the calculation of IDD and final duty liability. In an environment of lowering prices, the *ad valorem* method suffers a 42% loss in effectiveness, resulting in an under-collection of duty which comes at the expense of the Australian industry’s ability to recover from injurious dumping.

Moly-Cop notes the recent comments of the Commission in the Preliminary Affirmative Determination Report ("PAD") for *Dumping Investigation No. 319 (Chrome bar exported from Italy and Romania)* in relation to price and cost variability between different models and grades. Applied here, although there is some difference between the grades and models for the goods under consideration, Moly-Cop submits that they are not so significant as to preclude the setting of the variable component of the measures on the IDD by reference to the AEP. However, if the Commission considers that the price difference between the grades and/or models is such that a single AEP cannot be applied, then it is submitted that the lowest AEP determined for the goods under consideration be taken to form the variable component of the combination form of measures.

Similarly, the Commission in PAD 319 suggested that by reason of the magnitude of the dumping margins preliminarily determined, that the risk of the exporter reducing the export price to avoid the intended effect of the measures is less relevant. Firstly, should the applicant companies in this case, achieve significant dumping margins, then it is submitted that the size of those dumping margins are not necessarily prohibitive to an exporter from lowering export prices by amounts equivalent to the magnitude of the dumping margins to avoid the intended effect of the duty. Moly-Cop submits this position on the basis that in the absence of the combination method of IDD calculation, the exporter will be motivated to utilize the variable factors review provisions within the *Customs Act 1901*, to reduce the dumping margin to zero following the first review inquiry. Clearly, the use of the combination method removes this risk through the use of the AEP variable component of the measures, albeit revised following a review inquiry.

It is also noted in Report No. 234 that for related parties, the Commission preferred the use of the combination method for measures as this ensured the related parties were subject to a fixed AEP that prevented reductions to avoid the effect(s) of the measures.

It is for these reasons that Moly-Cop is again advocating for the calculation of IDD according to the fixed and variable method, in cases such as this, for commodity-type goods.

Conclusion

The Longte submission of 18 February 2016 is primarily a criticism of the Commission’s intended selected benchmark source for billet pricing. Longte has submitted that MEPS engages in “aggressive criticisms” of the Chinese steel industry and as such, MEPS data should not be used in benchmarking feed material input costs in a constructed cost for grinding balls for the Chinese exporter Longte.

Moly-Cop requests the Commission to disregard Longte’s assertions as unfounded and unsubstantiated. It is Moly-Cop’s view that MEPS is reputable and an impartial commentator on steel industry prices and is reliable for the intended purposes of the Commission.
Therefore, in summary, Moly-Cop’s position in relation to the determination of the exporters’ normal value under paragraph 269TAC(2)(c) of the Act is that it should be determined as follows:

- **Selection of an appropriate (commercial grade) billet benchmark** – Moly-Cop proposed the use of monthly MEPS domestic ex-works billet pricing for South Africa be used as the most appropriate (geographically remote from Asia region and steel production capacity best aligned with China ie. predominantly blast furnace/BOF rather than EAF);
- **Adjustment for alloy additions to ensure actual costs captured for billet suitable for grinding bar production** – Moly-Cop provides further information on alloying costs for consideration by the Commission in this submission; and
- **Addition of the conversion cost for the rolling of (alloyed) billet to grinding bar** – submission EPR 023 offered some alternatives in this regard.

Finally, Moly-Cop has again reiterates the view that IDD should be calculated according to the fixed and variable (ie. combination) method.

If you have any queries concerning this submission, do not hesitate to contact my colleague Matt Condon on 02 8424 9880.

Yours sincerely

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Vacuum Treatment of Molten Steel: RH (Ruhstahl Heraeus) versus VTD (Vacuum Tank Degasser)

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Abstract

In the beginning of their development in 1950s, RH and VTD were applied to produce quality steel in term of low hydrogen content for reducing of “hair crack” formation. In the mean time, both of these technologies are installed in steelworks in order to obtain high quality of steel products containing low hydrogen content, low nitrogen content, ultra low carbon content, low total oxygen content as well as ultra low sulphur content. The criteria of technology selection of these vacuum treatment techniques are strictly dictated by the steel grade to be produced. Intensive slag-metal interaction was observed during molten steel treatment on VTD which promotes a good condition for sulphur removal. On the other hand, less slag-metal interaction is taken place during RH treatment. Therefore, comparisons of RH and VTD treatments for impurities removal in molten steel are presented in this paper using some models for impurities prediction after vacuum treatment, consumptions and treatment cycle times, as well the availability of vacuum vessel. The capability of molten steel desulphurization on VTD plant through top slag and on RH plant by powder blowing are discussed.

Key words: RH, VTD, vacuum treatment, decarburization, degasing, desulphurization.

I. Introduction

Since 1950s, vacuum techniques were developed for degassing purposes. These techniques include DH (Dormund Hoerder) degassing, RH (Rurhstahl Heraeus) degassing, Vacuum Tank Degassing (VTD), Vacuum Arc Degassing (VAD), and Vacuum Induction Melting (VIM). Nowdays, there are two techniques commonly used for mass production of steel in order to reduce gases and carbon contents namely RH and VTD. In the new constructed steel plants, vacuum degassing facilities were considered and intergrated in the steel production line. There is also a trend for existing plants to install vacuum treatment facility to provide an opportunity for steel plant to extend the product mix and to be more flexible in order to respond the steel market situation.

Lower hydrogen and nitrogen content, ultra low carbon content, ultra low sulphur content, lower total oxygen content as well as steel cleanliness are the reasons for installing vacuum treatment facilities. The selection of RH or VTD is strictly dictated by steel grades to be produced. In most cases, the installation of RH vacuum degassing is more dominant, especially for big heat size, compared to VTD due to its excellent mixing performance, short cycle time for decarburization and degassing which results a great number of heat can be treated per day.
II. Vacuum Treatment by RH Degassing

In 1950s, RH degassing plant was developed and installed in Germany, Figure 1a. Since then, a lot of process improvements were performed on RH plant including the installation of oxygen lance in Hattingen\textsuperscript{1)}, the enlargement of snorkel and vessel diameters\textsuperscript{2)}, as well as the application of powder injection for desulphurization\textsuperscript{3,4)}. Comprehensive model for decarburization on RH plant was introduced by Kuwabara\textsuperscript{5)} considering the vacuum pressure, liffgas flowrate, vessel as well snorkel diameters. It was reported that the time required to achieve carbon content of less than 20 ppm can be completed in less than 15 minutes on RH plants\textsuperscript{2)}. 

![Figure 1. RH Degasser.](image)

A “microsoft-excel” based RH simulation model was developed for better understanding overall RH process starting from ladle arrival to RH station until ladle ready to be lifted by crane for continuous casting process. The simulation model consists of decarburization model which was proposed by Kuwadara\textsuperscript{5)}, degassing model by Janke\textsuperscript{7)}, deoxidation model, alloying model, temperature model, as well as desulphurization by powder blowing. The treatments on RH degasser is classified into four groups: degassing, light treatment, ultra low carbon steel (e.g. IF steel grades) and ultra low carbon steel silicon steel grade. Some calculation results are shown in Figure 2.

For some steel grades which has requirement that desulphurization shall be conducted on RH plant, the mixture of fluxes powder, e.g. CaO and Al\textsubscript{2}O\textsubscript{3}, can be blown through lance on the surface of molten steel during circulating in RH vessel. The model which is used to predict sulphur content during powder blowing was published previously\textsuperscript{3)}. The comparison of calculation and actual results during industrial trial of powder blowing at 300 ton RH plant is depicted in Figure 3.

Based on oxygen activity measurement in molten steel, deoxidation model was developed based on statistical model and aluminium yield model to determine amount of aluminium addition to achieve the final specification of aluminium content.
a. C-O equilibrium for carbon removal

b. Calculation results

c. Treatment diagram and temperature calculation

Figure 2. Output of RH simulation model.

a. Powder blowing through oxygen lance for desulphurization

b. Sulphur content profile

Figure 3. Desulphurization by powder blowing.
III. Vacuum Treatment by Tank Degassing (VTD)

The development of vacuum tank degassing is based on Mare’s proposal in 1938 for ingot casting under vacuum, Figure 4a. In 1950s, 150t vacuum ingot casting, also well known as “vacuum stream degassing (VSD)” was successfully installed and operated at Gußstahlwerk Bochumer Verein in Germany to produce turbine blade for power generation, Figure 4b. In the same period, Samarin started 22t ladle degassing in tank, Figure 4c. Steel stirring for degassing was promoted by boiling reaction in the melt which means that only unkillled / semikilled heat can be degassed by carbon monoxide formation. It was also observed severe damage on stopper rod and ladle lining during vacuum treatment. After introducing of porous plug for stirring and slide gate to replace stopping rod for casting, VTD was well developed.

![Figure 4. Vacuum Tank Degasser (VTD).](image1)

The task of VTD are principally similar to RH. However due to intensive slag-metal interaction on VTD, desulphurization can take place better on VTD provided that a suitable slag composition and amount are available during vacuum treatment. Slag-metal interaction results also negative impact on VTD due to silicon reversion from slag via carbon or aluminium reaction with silica which can increase silicon content in steel (silicon pick-up).

\[
\begin{align*}
\text{(SiO}_2\text{)} + 2\text{[C]} & \rightarrow 2\text{(CO)} + \text{[Si]} \\
\text{(SiO}_2\text{)} + \frac{3}{2}\text{[Al]} & \rightarrow \frac{2}{3}\text{(Al}_2\text{O}_3\text{)} + \text{[Si]}
\end{align*}
\]

Decarburization performance of VTD is less compared to RH due to less contact of molten metal to vacuum environment as well as excessive molten steel and slag boiling during vacuum treatment which is required to control vacuum pressure and argon stirring during treatment. Figure 5 shows the way to control vacuum pressure by flooding. Furthermore, ladle freeboard of 1000 – 1200 mm shall be considered for decarburization process.

![Figure 5. Flooding for boiling control.](image2)
For better understanding of VTD process, a “microsoft-excel” based simulation model was developed. Decarburization model which was proposed by Bannenberg\(^\text{10}\) is used to predict carbon content in molten steel. Degassing model is similar to RH degasser. For sulphur removal, the model which was introduced by KTH group\(^\text{11,12}\) is applied. The height of slag foaming is predicted based on the formula proposed by Fruehan\(^\text{13}\). The calculation results are shown in Figure 6 where around 20 to 25 minutes is required for decarburization. For production of ULC steel, a model to predict carbon and oxygen contents as well as temperature is mandatory since the temperature and oxygen activity measurements under vacuum are sophisticated compared to RH plant.

Based on oxygen prediction, the model calculate the amount of aluminium to be charged into VTD after decarburization for deoxidation as well as for aluminium alloying. The amount of burned lime is calculated to obtain final slag for desulphurization. The model calculate temperature profile during the whole process treatment on VTD as well. The prediction of sulphur content is shown on Figure 7. The quality of burned lime shall be well controlled in order to minimize carbon pick-up. As sulphur content reduced during vacuum treatment, at the same time, a good condition for nitrogen removal is achieved. Melt height is a critical

**Figure 6.** Output of VTD simulation model.
issue for VTD treatment, the model predict the melt height as function of vacuum pressure and amount of CO gas as shown in Figure 8.

Figure 8. Prediction of melt height during vacuum treatment.

IV. Comparison of RH and VTD

The selection of RH or VTD for steel plant is determined by steel grade to be produced. As it was stated previously, RH is very powerful for decarburization, Figure 9a. For steel plant which has focus on production of ultra low carbon steel grade (e.g. IF steel for automotive industries), RH shall be selected. For pipe steel or heavy plate, both of vacuum degassings can be considered principally. The performance of hydrogen removal is more or less similar between RH and VTD, Figure 9b. Desulphurization can be better conducted on VTD by top slag. In case of RH plant is applied, sulphur shall be removed before RH treatment, e.g. by hot metal desulphurization, better scrap control on BOF, and further desulphurization on LF or by powder injection facility. Desulphurization on RH by powder blowing is an option for such steel grade. For NGO steel, it is recommended to produce on RH due to ultra low carbon requirement and huge amount of alloying to be added. Sulfur removal can be conducted by powder blowing as the temperature of molten steel is high enough after silicon addition to compensate temperature drop during desulphurization. Quality of lime or fluxes shall be well controlled to minimize carbon pick-up.
The comparison of RH and VTD is summarized in Table 1. Overall, RH has more advantages over VTD. The limitations of RH plant are the requirement of RH vessel preheating, snorkel maintenance and exchange, more space, as well as high investment and operating costs.

**Table 1.** Comparison of RH and VTD.

<table>
<thead>
<tr>
<th></th>
<th>VTD</th>
<th>RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladle freeboard</td>
<td>600 – 1200 mm</td>
<td>200 – 300 mm</td>
</tr>
<tr>
<td>Heat size</td>
<td>More than 3 ton</td>
<td>More than 50 ton</td>
</tr>
<tr>
<td>Sampling, temperature and oxygen activity measurements</td>
<td>Taking sample and temperature measurement under vacuum is complicated</td>
<td>Taking sample and temperature measurement under vacuum is simple</td>
</tr>
<tr>
<td>Observation of molten steel height / surface during vacuum treatment</td>
<td>Depends on the opening diameter of ladle cover heat shield.</td>
<td>Easy by installation a video camera on hot-off take</td>
</tr>
<tr>
<td>Boiling</td>
<td>Vacuum pressure and argon stirring shall be well controlled to avoid excessive boiling.</td>
<td>Easy to control due to high freeboard of RH vessel.</td>
</tr>
<tr>
<td>Decarburization</td>
<td>&lt; 30 ppm in 20 minutes</td>
<td>&lt; 20 ppm in 15 minutes</td>
</tr>
<tr>
<td>Denitrogenization</td>
<td>&lt; 40 ppm</td>
<td>&lt; 40 ppm</td>
</tr>
<tr>
<td>Dehydrogenation</td>
<td>&lt; 1.5 ppm</td>
<td>&lt; 1.5 ppm</td>
</tr>
<tr>
<td>Desulphurization</td>
<td>Intensive slag metal reaction</td>
<td>Possible through powder injection and flux addition</td>
</tr>
<tr>
<td>Silicon pick-up?</td>
<td>Yes, SiO₂ content in slag shall be controlled to produce free silicon steel.</td>
<td>No, less slag metal interaction.</td>
</tr>
<tr>
<td>Vessel preheating</td>
<td>Not required</td>
<td>RH Vessel must be well heated before vacuum treatment</td>
</tr>
<tr>
<td>Vessel exchange</td>
<td>Not required</td>
<td>Snorkel is changed after ca. 100 – 150 heats</td>
</tr>
<tr>
<td>Space</td>
<td>Small space than RH</td>
<td>Large space is required for vessel drying, preheating as well as maintenance</td>
</tr>
<tr>
<td>Ladle refractory life</td>
<td>Shorter than RH</td>
<td>Longer than VTD</td>
</tr>
<tr>
<td>Overall investment cost</td>
<td>Low</td>
<td>Relatively high</td>
</tr>
<tr>
<td>Overall operational cost</td>
<td>Low</td>
<td>Relatively high</td>
</tr>
</tbody>
</table>
V. Vacuum Pump

In order to perform degassing and decarburization, a vacuum must be created inside of the RH vacuum vessel or inside tank of VTD by means of either steam jet pump system or dry pump system. The steam jet pump requires motive steam and cooling water for condensing the steam. Steam jet pumps can be designed as full steam pumps, Figure 10a, or as hybrid pumps, Figure 10b, equipped with liquid ring pumps as final atmospheric stage. The quantity of installed watering pump depends on the process requirement. Frequently, three to four watering pumps are delivered in which one of them is used as stand-by. Full steam ejector is usually preferred in converter steelmaking shop where some steam can be produced by converter waste gas cooling system. Hybrid pump is very often installed in electric steelmaking shop. Nevertheless, under some considerations, hybrid pump is also installed in converter steelmaking shop.

![Vacuum Pump Diagram](image1.png)

a. Full steam jet pump system  
b. Hybrid (steam ejector pump + WRP)

Figure 10. Vacuum pump.

Currently, mechanical dry vacuum pump, Figure 11, is preferred to be installed, particularly in electric steelmaking shop and minimill. The benefits of this installation are no condenser water and steam needed for vacuum generation which means that no boiler and water treatment plant are necessary. Furthermore, less space is required which makes the plant more compact.

![Typical Dry Mechanical Vacuum Pump](image2.png)

Figure 11. Typical dry mechanical vacuum pump.
However, waste gas must be filtered from dust particles generated during the process before it enters the pump system. The bag filter must be capable of removing fine dust with 50% of the particles with grain sizes of less than 2 µm. In order to have a waste gas temperature at the filter system ranging from 130 - 240° C as well as a dry pump inlet temperature of maximum 50°C, a gas cooling system is to be considered.

VI. Summary

RH and VTD plants have been compared and the selection of vacuum technology is dictated by steel grade to be produced. From operational point of view, VTD is more simple as it is not required special preparation e.g. vessel preheating, snorkel maintenance and exchange before vacuum treatment. Principally, VTD treatment can be performed at any time provided that vacuum pump is ready. However, carbon boiling and excessive slopping shall be taken care during the operation. Decarburization performance of VTD is inferior compared to RH. The degassing performance is more or less similar between both of these vacuum technologies. Desulphurization can be better conducted on VTD by intensive reaction between metal and slag under vacuum environment. Silicon pick-up shall be considered for silicon free steel by controlling amount of slag carry over. On RH, desulphurization is done by blowing of fluxes powder.

References
