

Independent Review of Events in the Nickel Market in March 2022

Final report | January 2023

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Executive summary

Over the course of three trading days in March 2022, the price of nickel increased by over 270% on the LME. The speed and scale of the price movement was unprecedented for a major commodity in recent times.

The LME Group engaged Oliver Wyman and NERA, both part of Oliver Wyman Group, to conduct an independent review of the events in the nickel market, leading up to the decision of the LME to suspend the market.

The primary objectives of the review were to identify the factors that contributed to market conditions in the nickel market in the period leading up to, and including, March 8, 2022, and make recommendations for how the LME Group could reduce the likelihood of similar events occurring again.

Description of events

The analysis of events shows nickel underwent a short squeeze: there were large, exposed short positions; a lack of willingness to provide liquidity; a price spiral and resultant margin calls; and consequent rapid risk

reduction by participants exposed to those large short positions.

Large short positions had been built-up by a number of participants – both on-exchange and on the OTC market - well before March, ostensibly as part of hedging programmes. By March 3, the rise in prices across all metals, driven in part by Russia's invasion of Ukraine, had increased margining requirements for metals producers and traders. The quality of liquidity on the nickel market had also started to decline.

March 4 saw an initial price divergence between nickel and other non-ferrous LME metals. Smaller physical nickel producers and traders began to cover short positions held in LME and OTC contracts. This appears to have been the start of the short squeeze.

The price trend accelerated in early hours trading on Monday, March 7. Reinforcing cycles of buying ensued where rising prices led to market participants facing rapidly growing margin calls, which prompted further buying to reduce risk, which in turn drove further price increases.

By market close on March 7, nearly 11,500 lots of pre-existing short positions had been closed out and the price had risen 69% from the last traded price on March 4 to \$50,300/t. Within a few hours of opening on

March 8, the price surged to over \$100,000/t with the continued closure of positions.

After that threshold was breached, the price fell back around 20%, before trading was suspended at 08:15. Between March 4 and March 8, nearly \$16bn in margin calls had been met by LME members.

Contributing factors

The review analysed a wide range of factors that could have contributed to the events, including underlying risks, processes and controls, and market structure, and assessed whether they drove, exacerbated, or failed to mitigate the events. In line with its scope, the review did not look at decision-making and governance at the LME Group as these matters are the subject of regulatory reviews being undertaken by the Bank of England and the Financial Conduct Authority. In addition, the review does not address whether or not there may have been suspicious trading behaviour. If any was identified, it would have been flagged to the LME who would then assess whether to undertake their own investigation.

The existence of large, exposed short positions was in part due to the LME's inability to identify and address these positions as they were built-up. The fragmentation of large positions across members and between

on-exchange and OTC markets contributed to this by reducing visibility of risks. Further, regulatory position limits and the LME's accountability levels did not prevent the build-up of these positions. Position limits were too high to meaningfully affect trading activity, and accountability level investigations did not identify these positions.

The withdrawal of liquidity, both ahead of March 4 and then during the events, was driven by underlying factors specific to the market at that time, as well as its participant mix. The nickel market is known to be volatile, prone to distortion, and exposed to geopolitical risks, reducing the willingness to provide liquidity as potential threats to Russian supply captured the market's attention. In addition, the market believed at the time that there was pressure on large short positions. This made participants wary of positioning on the wrong side of potential price moves. This general reluctance to provide competitive liquidity was exacerbated by the absence of a diverse range of participants able to take opposite positions.

The withdrawal of liquidity led to outsized price impacts of trading from March 4 onwards. For instance, on March 8, buy trades moved the price over \$250/lot on average. This in turn triggered record margin calls, further increasing pressures on major short positions.

The severity of the price spiral was not controlled by the LME's price volatility controls during the events. While the LME had controls in the form of dynamic and static price bands, they did not ultimately stop the run-up in prices. Eventually, market participants began to think that some members might be insufficiently robust to weather the events, with market rumours claiming a member had failed to pay a margin call seen by participants as adding to market pressure to reduce risk by closing short positions.

As participants exposed to short positions (both end-users and their OTC counterparties) came under increasing pressure, they started buying to close out positions. This pressure was particularly acute for some producers due to the emergence of basis risks from the use of LME nickel prices to hedge against Class 2 production. As LME nickel prices rose rapidly, producers with such hedges faced risks to the solvency of their businesses. Depending on the extent of their exposure, solvency concerns could have hampered their ability to raise additional funds to pay variation margin calls. The rapid risk reduction was conducted directly on the exchange, effectively exhausting market liquidity during the events. There was not a well-rehearsed approach among members to close-out significant positions without affecting market orderliness.

Recommendations for the LME and LME Clear

The independent review has recommended objectives and measures that, if implemented by LME Group, should reduce the likelihood and impact of events similar to those that took place in nickel in March 2022.

The recommendations introduce layers of defence that should improve the LME Group's ability to identify, prevent and manage risks of market distortions. They also include measures that could support the rebuilding of confidence in the LME market.

To better identify risks and prevent extreme events, the review recommends the LME Group extend the mandate of its risk and control functions to explicitly cover the identification and prevention of market distortions, and upgrade capabilities accordingly. LME rules and enforcement processes to prevent risks of market distortions should be tightened. One suggested measure is to adopt LME-specific position limits and to revamp the existing accountability level framework to help address risks created by large positions. Given the importance of the OTC market to the events, the LME should also monitor significant risks in the OTC market to manage the risks of LME market distortions. Measures could include requiring members to notify the LME when client positions reach set materiality thresholds, or when clients miss significant margin calls.

The review recommends that the LME seek to enhance its ability to manage and control extreme events should they occur again in the future.

This should include upgrading volatility controls to slow down extreme price moves – including by calibrating in more detail price limits instituted following the events, and improving communication around the state of the market.

Further, the LME should aim to build operational readiness across the market for extreme events, including looking at developing processes with members to effectively manage client defaults on OTC as well as centrally cleared positions.

The review also recommends that the LME Group should seek to rebuild confidence in the market following the events in March. It should consider tightening rules to improve perceptions of member and LME Clear resilience, and provide a clear vision for how the LME will respond to events and rebuild liquidity.

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Introduction

Background to the LME

Founded in 1877, the London Metal Exchange (LME) is the world's largest trading venue for industrial metals. Most of the world's non-ferrous metals futures business is conducted through the LME, with large markets in aluminium, copper, zinc, nickel, lead, and tin, and over 3.5bn tonnes of metal changing hands annually. Since 2012, the LME Group has been owned by Hong Kong Exchanges and Clearing (HKEX).

The strategic principles of the exchange are to serve the physical market, ensure fairness, increase user choice and to maximise trading efficiency (as described by the LME Group in exhibit 1).

LME futures contracts are settled using physical stock that meets the LME's specifications at any of its network of 550 warehouses. Since 2014, trades executed on LME venues are centrally cleared on LME Clear, an LME affiliate and wholly-owned subsidiary of HKEX.

Market participants, including metals producers and processors, consumers, and financial institutions, typically use the LME to gain exposure to or hedge against changes in metal prices, rather than to secure supply or deliver physical metal. Fewer than 1% of LME

contracts result in physical delivery of metal, with the balance being closed out before settlement.

Market participants access trading on the LME through LME members which include global and regional banks, specialist metals traders and diversified commodities traders.

Trading on the LME takes place across three trading venues: an online central order limit book ('LMEselect'), open outcry trading ('the Ring'), and bilaterally-negotiated trading reported to the exchange ('inter-office').

LME prices and the LME's metal settlement system are also referenced in contracts for trades agreed bilaterally and not reported to the exchange ('over-the-counter' or 'OTC'), whether by electronic messaging, voice, or on single-dealer platforms run by members.

LME prices are also widely used as reference prices in long-term contracts in the industrial metals supply chain. These contracts typically specify a fixed schedule of volume to be delivered at the LME reference price plus a discount or premium.

The LME is a recognised investment exchange (RIE) coming under the jurisdiction of the UK's Financial Conduct Authority (FCA). LME Clear is authorised and regulated in the UK by the Bank of England.

Exhibit 1: LME strategic principles

Serve the physical market

Provide pricing, risk management and terminal market services to the global physical metals industry

Physical market linkage ensures LME prices appropriately reflect real world supply and demand, and maintains the broad ecosystem desired by all LME participants

Increase user choice

The LME's market structure should be suitable to meet the varied needs and preferences of its users rather than provide a model that forces all participants to trade in the same way

Ensure fairness

The LME's primary responsibility is to ensure fair and non-discriminatory access to its market

The value of the LME market is maximised by allowing the broadest possible range of participants to hedge and invest, and ensure that all those participants have fair access to information

Maximise trading efficiency

It is in the mutual interests of participants, the LME and the broader market that customers be able to trade as extensively as they wish, unencumbered (as far as possible) by the frictional costs of trading

Source: LME Group

Review objectives and methodology

The LME Group engaged Oliver Wyman and NERA, both part of Oliver Wyman Group, to conduct an independent review of the events in the nickel market leading up to the suspension of the market on March 8, 2022.

The primary objectives of the review were to identify the factors that contributed to market conditions in the nickel market in the period leading up to, and including, March 8, 2022, and make recommendations for how the LME Group could reduce the likelihood of similar events occurring again.

The scope of the review explicitly excludes LME Group's decision-making processes and governance arrangements given these will be considered as part of the regulatory reviews undertaken by the Financial Conduct Authority and the Bank of England.

The review's terms of reference cover current practices and future recommendations across four areas:

- The LME Group's market structure, including the supporting ecosystem of brokers and regulatory requirements.

- Trading rules, and trading controls on the LME (including but not limited to position management and volatility controls).
- Physical contract specifications and broader links to the physical market (including stock levels).
- Risk management policies and practices, clearing model and collateralisation levels of the LME, LME Clear and their members.

The review includes recommendations for how the LME Group could address the issues identified, with a view to reducing the likelihood or mitigating the impact of similar events, in nickel or other metals markets.

It is not the purpose of the review to apportion responsibility or blame for the events.

Methodology

The independent review team has analysed data provided by the LME, LME Clear, and their members covering the four areas listed above. The data reviewed included, but was not limited to, orders and trades made on LME venues and in OTC markets, and margin call data from LME Clear and members.

Following an open request for input, the review team interviewed or received written input from 40 market participants and interviewed 27 LME Group stakeholders.

Additionally, it has compared LME Group policies and procedures with peer and global best practices.

The review team wishes to thank members, market participants, and LME Group stakeholders for their time and extensive input.

This document

This report is the final output of the review and is being shared in full with market participants. The analysis and recommendations the report contains are those of the independent review team.

Throughout the review, the LME Group has provided full access to data and documents, and the review team has worked extensively with relevant individuals and operational teams to fact-check analysis.

The review does not name specific members or end-users and has anonymised data to avoid the identification of specific participants.

Key terms used in the report are defined in the glossary. In particular, it follows the LME's definition of an over-the-counter (OTC) trade, which refers to trades agreed bilaterally between two parties, without the supervision of an exchange and not centrally cleared. For the avoidance of doubt, inter-office trades cleared by LME Clear are described as exchange-traded (ETD) positions in the review.

Background on the nickel market

Nickel is a non-ferrous metal predominantly used in the manufacture of stainless steel, and non-ferrous alloys and plating (64% and 13% of demand respectively). Nickel is also a key component in certain battery types, which today accounts for 15% of nickel demand, and is expected to grow due to use in electric vehicle production.

Nickel occurs in two ore types: sulphides and laterites, which are processed into a range of nickel products and intermediates. High purity Class 1 refined nickel such as briquettes and cathodes makes up 25% of supply, predominantly used in Europe and the Americas. Almost all the growth in nickel supply over the last 10 years has been in nickel pig iron (NPI), a type of ferronickel (FeNi) of between 3–14% purity, developed in China as an alternative to pure nickel in stainless steel production. Today, NPI accounts for 50% of worldwide nickel supply. Higher-purity FeNi alloys which contain around 35% nickel by mass account for another 11% of supply.

Nickel matte, mixed hydroxide precipitate (MHP) and nickel sulphate are intermediate and final nickel

products that are involved in the battery supply chain, with their supply expected to grow in coming decades.

Extraction of nickel is concentrated in Indonesia (48%), the Philippines (14%), and Russia (6%) – with Indonesia and the Philippines expected to remain the main sources of supply over the next decade.

Refined nickel is stable and easily stored. However, other nickel products can present handling and storage challenges, ranging from being bulk commodities (NPI, FeNi) to hard to store powders (nickel sulphate and matte).

The LME has had a physically settled nickel contract based on high purity nickel (>99.8%) since 1979. An LME traded nickel lot constitutes 6 metric tonnes, must be in cathode, pellet, briquette, or round form and be of an LME-approved brand.

LME volume reports show that in 2021, nickel comprised 12% of the non-ferrous metal futures and options volume on the LME, compared to 42% for aluminium, 22% copper, and 16% for zinc.

Exhibit 2: Nickel market facts and figures (2021)

2,921 kt

Annual consumption of nickel

\$18,457/t

Average closing price of LME 3month nickel

**10,970 lots
(66 kt)**

Daily outright traded volume of LME nickel contracts¹

**224 k lots
(1,344 kt)**

Average open interest on LME exchange for nickel futures contracts²

7.6%

Average ratio of initial margin rates to LME 3month nickel price

\$391m

Average daily variation margin called by LME Clear (across all metals)

1. Sept 2021 – Feb 2022 inclusive, across all LME venues and prompt dates; 2. Sept 2021 to Feb 2022 inclusive
Source: LME data, Wood Mackenzie

Description of events

Introduction to the description of events

Over the course of three trading days in March 2022, the price of nickel on the LME increased by over 270% – from \$27,080/t to \$101,365/t, before falling to around \$80,000/t. Following the price surge on March 8, the LME suspended the market. The speed and scale of the price movement was unprecedented in modern times for a major commodity.

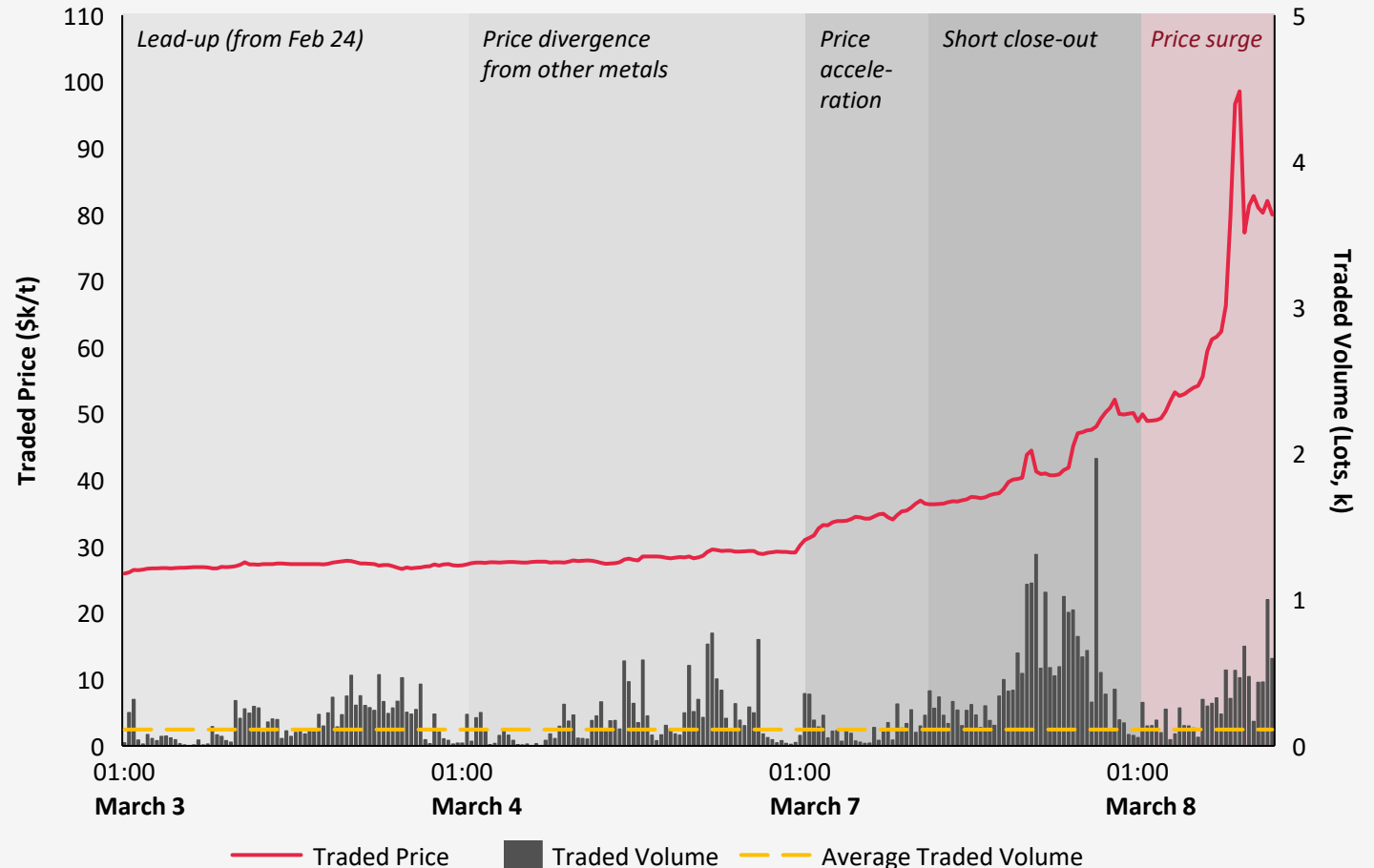
The events in nickel were a short squeeze. A short squeeze occurs when rising prices create pressure on holders of short positions by increasing their margin call requirements. This pressure then translates into short-covering trades to reduce risk, further accelerating the price move and forming a vicious cycle.

This analysis of events aims to explain market activity on those three days, including buying and selling on LME venues and in the over-the-counter (OTC) market, the depth and nature of liquidity in the market, and the resulting impact on LME nickel prices.

The analysis is divided into five distinct periods, each with a different set of market conditions, external events or media coverage – summarised in exhibits 3 and 4.

Exhibit 3: LME 3month nickel traded price and volume

01:00 March 3 – 08:15 March 8



Note: 15 minute windows are shown on the graph above and the price is the volume weighted average LME 3month nickel trade price in this 15 minute period. The 15 minute window also applies to the traded volume and average traded volume
Source: LME data

Description of events

In the lead-up (prior to March 4), prices rose against a backdrop of external risk factors including the growing threat of sanctions on Russian nickel producers and low nickel warehouse stocks. Following the invasion of Ukraine on February 24, nickel prices rose in line with other metals and bid-ask spreads remained at typical historical levels.

Large short positions had been built-up by a number of participants long before concerns over the invasion of Ukraine surfaced. Short positions are used in hedging programmes to manage the price risk of production, but two positions, both with significant OTC components, were particularly large in relation to the financial resources of their owners.

By March 3, the rise in prices across all metals had increased margining requirements for metals producers and traders and resting ask orders in the order book had declined relative to historical norms.

Friday, March 4, saw an initial price divergence between nickel and other non-ferrous LME metals. Smaller physical nickel producers and traders began to cover short positions held in LME and OTC contracts, with 10 physical participants accounting for almost 50% of risk-reducing trades on March 4. This led the nickel price to dislocate from other metals and appears to have been the start of the significant short squeeze that followed.

Exhibit 4: Market characteristics during the events

Period	Price divergence				
	Lead-up	from other metals	Price acceleration	Short close-out	Price surge
Time period	Feb 24 – March 3	March 4	March 7 (01:00 – 07:00)	March 7 (07:01 – 19:00)	March 8 (01:00 – 08:15)
Short-closing on-exchange risk positions deltas (Lots)	3.9k ¹	4.5k	1.3k	10.2k	1.4k
Price at start of period (\$/t)	Ni: 24.5 Al: 3.3 Zn: 3.6	Ni: 27.1 Al: 3.8 Zn: 4.0	Ni: 29.8 Al: 3.9 Zn: 4.2	Ni: 36.0 Al: 4.0 Zn: 4.2	Ni: 50.0 Al: 3.8 Zn: 4.1
Price move during period	Ni: +10.6% Al: +14.6% Zn: +10.7%	Ni: +7.4% Al: +0.2% Zn: +1.3%	Ni: +20.9% Al: -4.3% Zn: +0.3%	Ni: +39.7% Al: +5.2% Zn: -1.5%	Ni: +60.0% Al: +2.7% Zn: +2.1%
Volumes – average LMEselect 3month (lots/minute)	12.8	15.7	11.9	33.0	24.0
Bid-ask spread – average LMEselect 3month (\$/t)	18	33	136	148	433
Orderbook depth within 1% ² – average Select 3month (lots)	Bid: 101 Ask: 81	Bid: 76 Ask: 97	Bid: 30 Ask: 28	Bid: 199 Ask: 26	Bid: 44 Ask: 19
Average order book price impacts ³ (\$/lots)	7	12	44	30	99

1. Average daily amount; 2. Distance from opposite side of orderbook;

3. Price impact measured as difference between the traded price and the best bid/ask at 0.001 seconds later

Source: LME data

Description of events

The price trend accelerated in early hours trading on Monday, March 7. Reinforcing cycles of buying – primarily on LMEselect – ensued. Rising prices meant market participants faced rapidly growing margin calls, which prompted further buying to reduce risk, which in turn drove further price increases.

The rest of March 7 saw a widespread exit of positions including by the holders of the largest concentrated short positions and their OTC counterparties. By market close, nearly 11,500 lots had been closed out and the price had risen 69%, from \$29,770/t at open to \$50,300/t at close.

The market opened above \$50,000/t on March 8, climbing to around \$70,000/t before prices surged at 5:30am. The price spiked to over \$100,000/t with continued closure of positions. After that threshold was breached, the price fell back to around \$80,000/t before trading was suspended at 8:15 am. Between March 4 and March 8, nearly \$16bn of margin calls had been met by LME members.

Overall, the events can be broken down into the following elements:

The existence of large, exposed short positions:

Large short positions had been built up by a number of participants long before concerns over the Russian invasion of Ukraine surfaced. Two positions in particular,

both with significant OTC components, were large in relation to the financial resources of their owners.

The withdrawal of liquidity: In the days prior to March 4, the depth of resting ask orders declined from an average of 820 lots, to an average of 260 lots, while bid orders increased. Two-way liquidity providers on LMEselect, whilst not the largest source of liquidity on the venue, made less competitive prices. Low liquidity meant that modest buy order volumes from physical players on the March 4 and early on March 7 had an outsized impact on prices. Once the short squeeze had commenced and prices rose, few participants were willing to assume new short positions, and very few counterparties were seemingly in a position to sell and take profits.

The price acceleration and resultant margin calls:

The price increase on March 7 of 69% was nearly five times greater than the next biggest move in nickel in the last twenty years. Market participants faced significant margin calls as a result, both to LME Clear and on OTC trades. Members paid nearly \$16bn in margin calls to LME Clear between March 4 and March 7, and by March 8 there was almost \$6bn of total OTC margin outstanding from clients to their members.

Rapid risk reduction by participants exposed to large short positions:

As participants exposed to short positions came under pressure to meet spiralling

margin calls, they started buying to close out positions on exchange. This pressure was particularly acute for large producers using the LME to hedge production of NPI, who would have faced major losses on their hedges and have consequent concerns around solvency. The majority of net buying over March 4 to March 8 was by participants with short positions on-exchange or counterparties to large OTC short positions. This extensive buying activity exhausted liquidity on the market, exacerbating the price spiral.

The remaining pages in this section are a detailed description of the events as they unfolded.

The lead-up

Before March 4

Russia’s invasion of Ukraine on February 24 increased the risk of sanctions on Russian nickel producers and related supply disruptions. This shock affected a market that was already affected by tight supply and had divergent views on the medium-term outlook.

In the months leading up to February, there were opposing views on the long-term demand and supply balance for nickel.

The more bullish view centred around strong projected growth in electric vehicle (EV) manufacturing and consequent increased demand for nickel in batteries, along with generally strong demand growth as the global economy recovered from COVID-19 disruption faster than supply could expand.

In an alternate view, planned expansion of Class 2 nickel supply, primarily NPI, would result in a medium-term oversupply. Technological advancements allowing the conversion of NPI into battery-grade nickel would also reduce prices for Class 1 nickel. Indeed, a prior announcement by a major producer that it would convert NPI to Class 1 nickel in March 2021 saw LME nickel prices fall around 7%.

Some EV manufacturers hedged against Class 1 shortage risks, buying forward multiple years' worth of expected consumption. Some producers, reportedly taking the view that prices were too high given expected new production, sold nickel forward and amassed large short positions.

Positions on both sides were large and concentrated when compared to nickel trading volumes. The largest long position was 27,000 lots (162kt), while four LME users were short between 13,000 and 24,000 lots (78kt – 144kt) each. These positions were established well before February. Some were centrally cleared via LME Clear while others were entirely placed on the OTC market, and most were spread across multiple LME members as counterparties.

Levels of warranted nickel stocks in LME warehouses had been steadily declining, from 173kt on September 15 to 80kt by February 24, reaching the equivalent of only ten days of worldwide nickel demand. This decline was consistent with the stocks of other LME metals, including copper and aluminium. Further, 89% of LME nickel warrants were owned by just three entities.

On February 14, market rumours around the presence of large short positions and the concentrated ownership of nickel stocks were reported¹ in the press.

Exhibit 5: Cash, 3month, 15month, 27month and 63month contract prices, \$k/t, January 4, 2021 – March 3, 2022

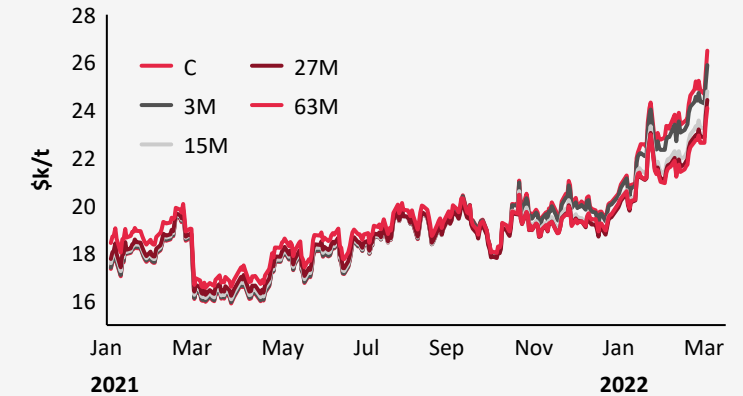
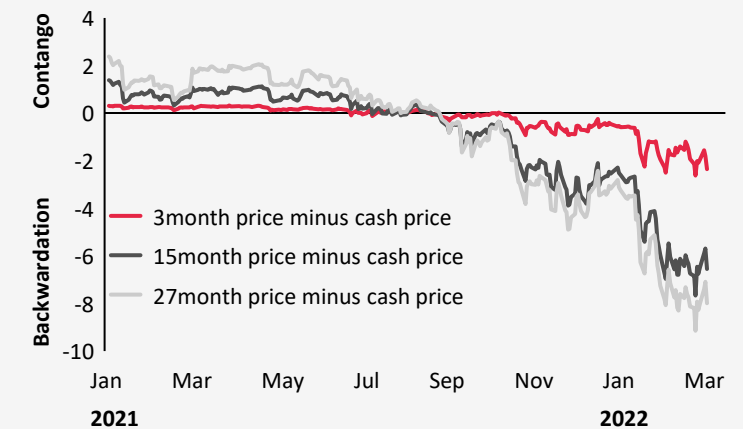


Exhibit 6: Difference between LME nickel Cash price and 3month, 15month and 27month prices as a percentage of 3month nickel price, %, January 4, 2021 – March 3, 2022



Source: LME data

1. Bloomberg, “Trader Known as ‘Big Shot’ Battles Mystery Nickel Stockpiler”

Description of events

When Russia invaded Ukraine on February 24, the price of nickel, along with that of other metals and commodities rose, reflecting the risk of potential sanctions on Russian producers and other related supply disruptions (as seen in exhibit 7).

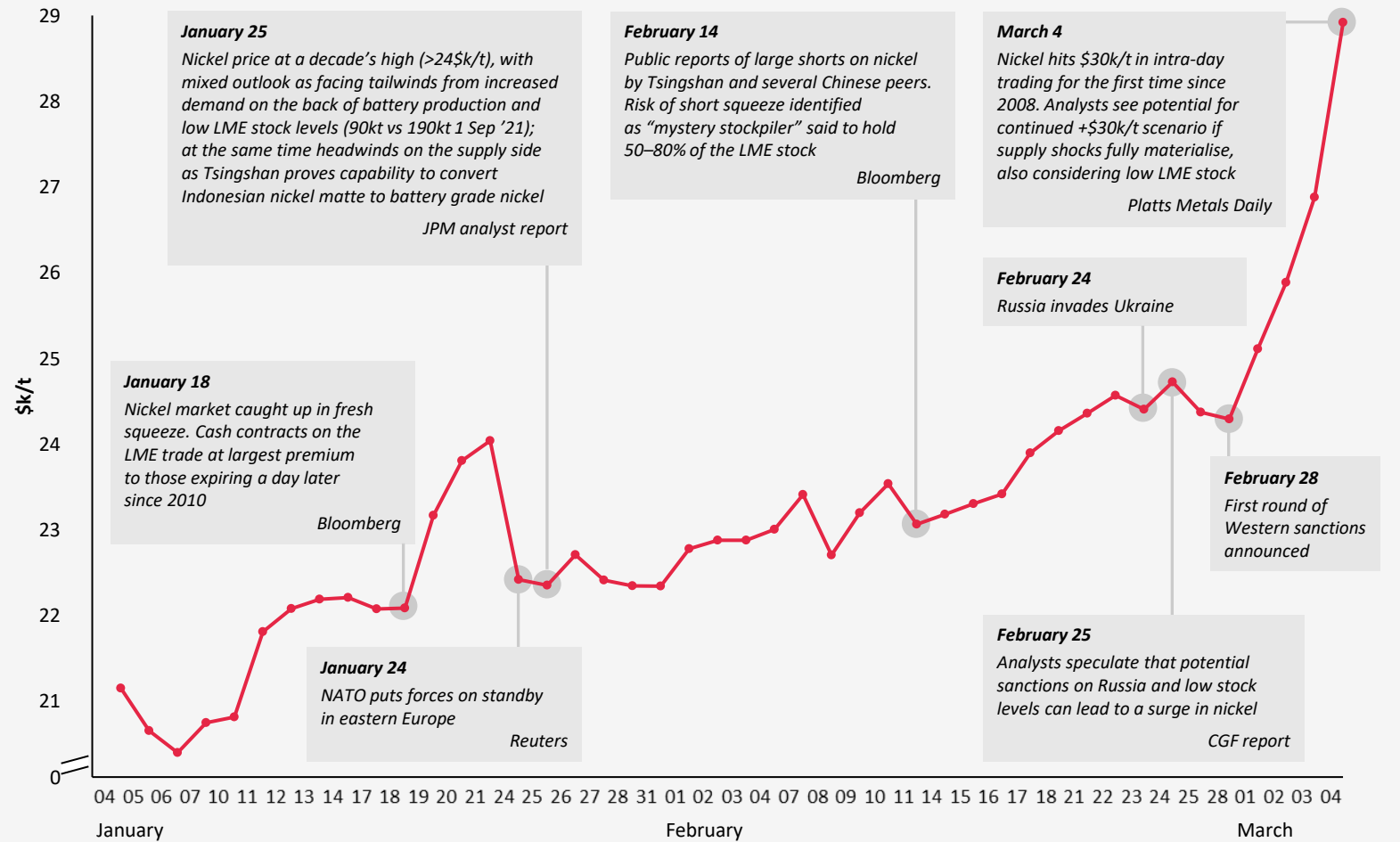
On February 24, LME 3month nickel prices hit ten-year highs intraday, up 4.8% on the day to \$25,677/t, while the 3month LME aluminium contract reached record highs of \$3,475/t, up 5.7% on the day. Aluminium had previously seen sanctions-related supply disruption following US sanctions against a major Russian producer in 2018.

Between March 1 and March 4, there were indicators of worsening market liquidity. While trading volumes remained stable, resting limit sell orders on LMEselect declined to around 30% of typical levels, with some extended periods seeing less than 10% of typical sell order volume. During this period liquidity providers of all types became more cautious, quoting wider bid-ask spreads and more rapidly adjusting prices as buy orders were entered and matched.

At market close on March 3, the traded price of LME 3month nickel had reached \$27,112/t – 10.6% above market open on the day Russia began its invasion.

Exhibit 7: LME 3month nickel closing price and key public information before the events

January 4 – March 4, 2022



Source LME data, reports as described

Price divergence from other metals

March 4

The 3month nickel price diverged from other metals as media reports described some physical producers closing out short positions.

As shown in exhibit 8, within an hour of market open at 01:00 on Friday, March 4, prices increased nearly 2%. By 10:30, prices had significantly diverged from other metals, with nickel (mid-price) up as much as 6.7% (\$28,970/t), while none of other five major non-ferrous contracts were up more than 1%.

Media reports¹ around 15:00 described some LME clients being 'forced to close out their positions in an increasingly illiquid market', pointing specifically to physical producers with short positions.

Trading analysis shows that over 50% of outright buying volume on March 4 was from 5 physical producers/traders – some of whom materially reduced or closed out short positions fully. These trades appear consistent with the closure of hedges to reduce potential margin calls as prices continued to rise. In total, physical players reduced exposure to nickel by 2,760 lots on March 4.

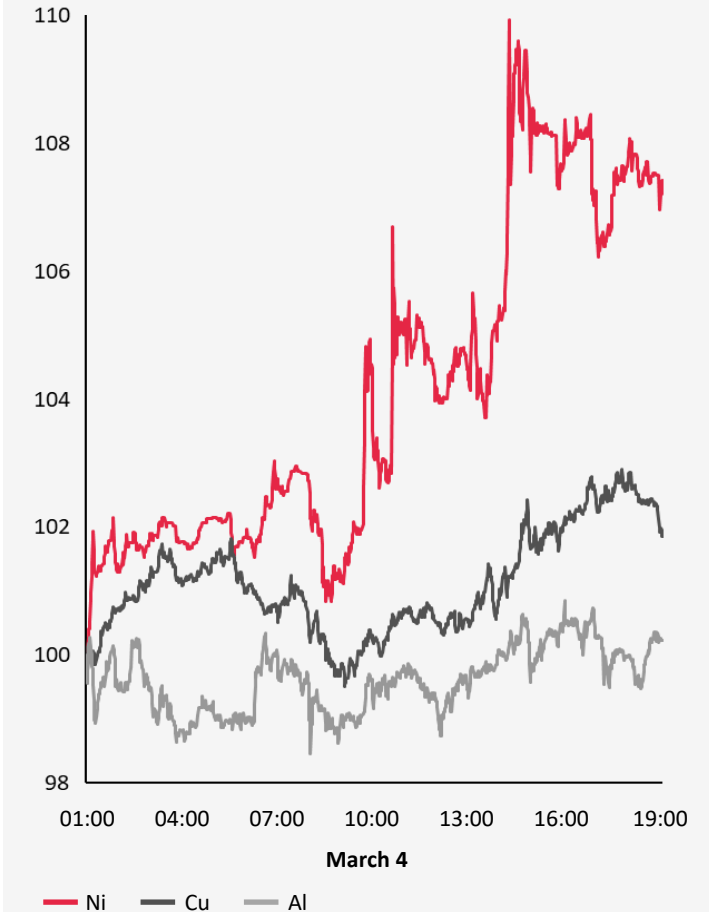
During the afternoon, the price reached close to \$30,000/t, for the first time since 2008, with the final trade on the day executing at \$29,130/t – a 7.6% increase from the opening price. That price move was large, but not unprecedented for a metal which has seen 13 days with price moves greater than 10% since 2002.

Total margin calls generated (largely due to mark-to-market losses on LME nickel contracts²) were over \$3.5bn – of which \$2.6bn was called during the trading day. This was higher than the aggregate margin called in any day in the prior five months, and around three-and-a-half times the average level over the same period.

The market closed for the weekend with significant short positions still in place and worsening liquidity. Holders of these positions had seen their available liquid financial resources depleted by large margin calls. While traded volume on March 4 was high, (17.6k lots traded on the 3month contract versus an average daily volume of around 11.3k lots in 2022) the bid-ask spread exceeded \$250/t at times – compared to an average of \$15/t for the prior six months. The price impact of a single buy order on LMEselect had begun to materially increase as well.

Exhibit 8: LME 3month prices of nickel, copper and aluminium

Rebased to 100 at 01:00, March 4



Source: LME data

1. Bloomberg, "Nickel Tops \$30,000 for First Time Since 2008 Amid Short Squeeze"; 2. Margin calls are aggregate across all metals but other major metals did not experience extreme price moves

Price acceleration

March 7, 01:00 – 07:00

When the market reopened at 01:00 on Monday, March 7, the price increase accelerated as market liquidity continued to deteriorate, causing another round of large margin calls.

At market open at 01:00, nickel immediately breached \$30,000/t, higher than at any point the day prior. Within an hour, prices had increased another 10.8% to \$33,000/t – a larger increase than the full day of March 4. The full development of prices over the period is in exhibit 9.

No large short positions were materially reduced during this first hour of trading, nor longs established. However, multiple small market participants, each with positions only a fraction of the largest shorts in the market, began to aggressively close their positions.

Still, net short covering over the period amounted to around 1,300 lots, a relatively insignificant volume when compared to historical averages.

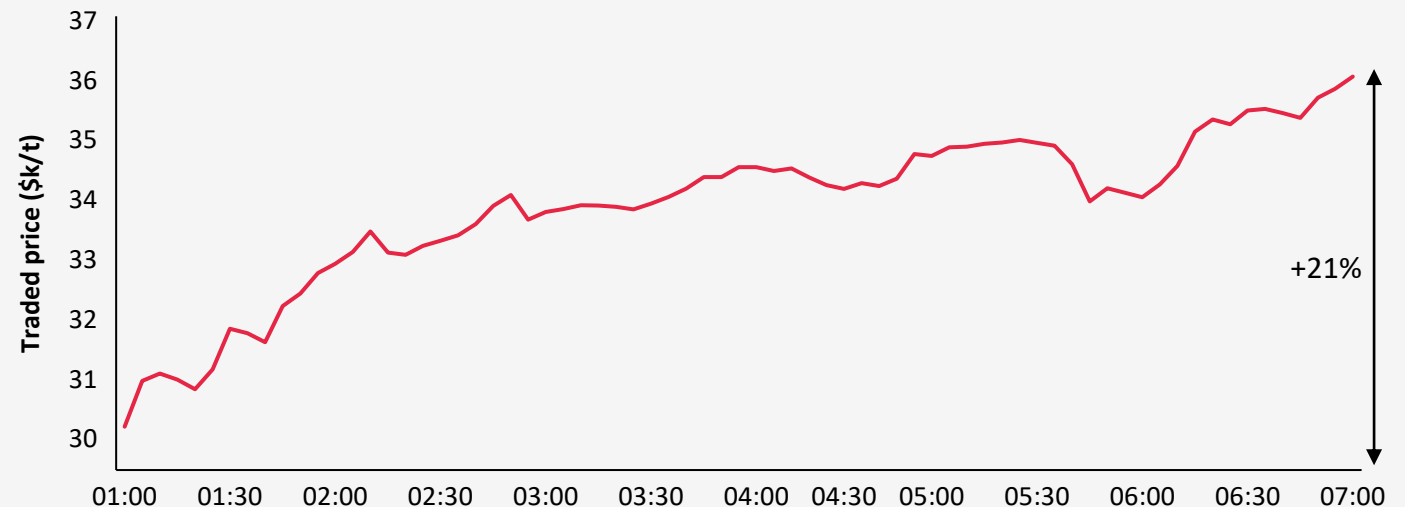
What had changed, however, was the depth and quality of liquidity. The average bid-ask spread averaged almost \$150/t and the depth of resting sell orders at competitive prices had become almost non-existent

(averaging fewer than 30 lots within 1% of the best bid).

By 07:00, the price was just over \$36,000/t, up 21% from the open. It had already exceeded the largest daily increase in the past two decades (14%) and was comparable with the worst-case scenarios (23%) used in the regulatory stress test LME Clear completed with ESMA in 2019, which was meant to play out over five trading days.

LME Clear made its first margin calls a little after 07:30, as is standard process. The price movement on the morning of March 7 was so significant that members were called for over \$5.1bn in that first margining run – based only on mark-to-market losses already sustained that day. This was over five times the average daily aggregate margin call and meant members had posted \$8.7bn in less than two days of trading.

Exhibit 9: LME 3month nickel traded price per 5 minute intervals, \$k/t
01:00 – 07:00, March 7



Note: The price is the volume weighted average LME 3month nickel trade price in each 5 minute period
Source: LME data

Short close-out

March 7, 07:01 – 19:00

The price increase and sizeable margin calls put further stress on market participants, and the speed and magnitude of risk reduction gathered pace. Counterparties, including some of the biggest short-holders, started to miss large bilateral margin payments on OTC positions.

For ETD contracts, four members did not meet the 07:30 margin calls by 09:00, which is LME Clear's designated timeframe¹. In addition, a further member's call was noted internally as having been outstanding, but the call was ultimately cancelled because the member posted alternative collateral prior to the deadline. The number of delays was relatively high - by comparison, no calls had been delayed except for operational issues attributable to settlement banks in the prior six months.

Short position covering increased over the period and overall net shorts reduced by 10k lots between 7:01 and 19:00. Much of this risk-reduction (44%) came from members either rebalancing hedges for OTC positions being closed by counterparties, or by those with large OTC contracts whose counterparties had begun to miss margin calls and were therefore looking

to manage potential price exposure.

By the close of trading, large short positions remained in the market– with the top 5 short-holders still holding 57k lots compared to 61k lots held by the top 5 short holders at the start of March 4.

With prices having breached \$50,000/t, the need to cover those shorts was even more pronounced. Member data analysed following the events indicates that of the missed OTC margin calls on March 7 and 8, over \$2bn can be attributed to only two clients.

After 06:00, one financial client with no material existing nickel position started to accumulate a long position on the exchange that reached over 2,000 lots by end of day. This represented 13% of net buying on March 7.

Bid-ask spreads remained very wide and increased buying pressure further skewed the balance of the LMEselect order book (exhibit 14), which had significantly more bid than ask orders. The average price impact of executing a 1-lot buy order reached \$44/lot, measured as the difference between the traded price and the best bid/ask 0.001 seconds later. This reflected the broad pull-back from all kinds of liquidity providers making competitive prices. Whilst volumes remained high due to continued risk reduction, there was a very large premium being charged by those providing liquidity.

In the early afternoon, at 13:13, traded prices touched \$46,450/t, up 51.7% on the day.

LME Clear suspended intraday margin calls shortly afterwards, at 13:30, by which point it had already called nearly \$7.5bn that day (exhibits 10 & 11). Two members had received calls for over \$1bn each, and one member was yet to settle its obligations from the morning margin call.

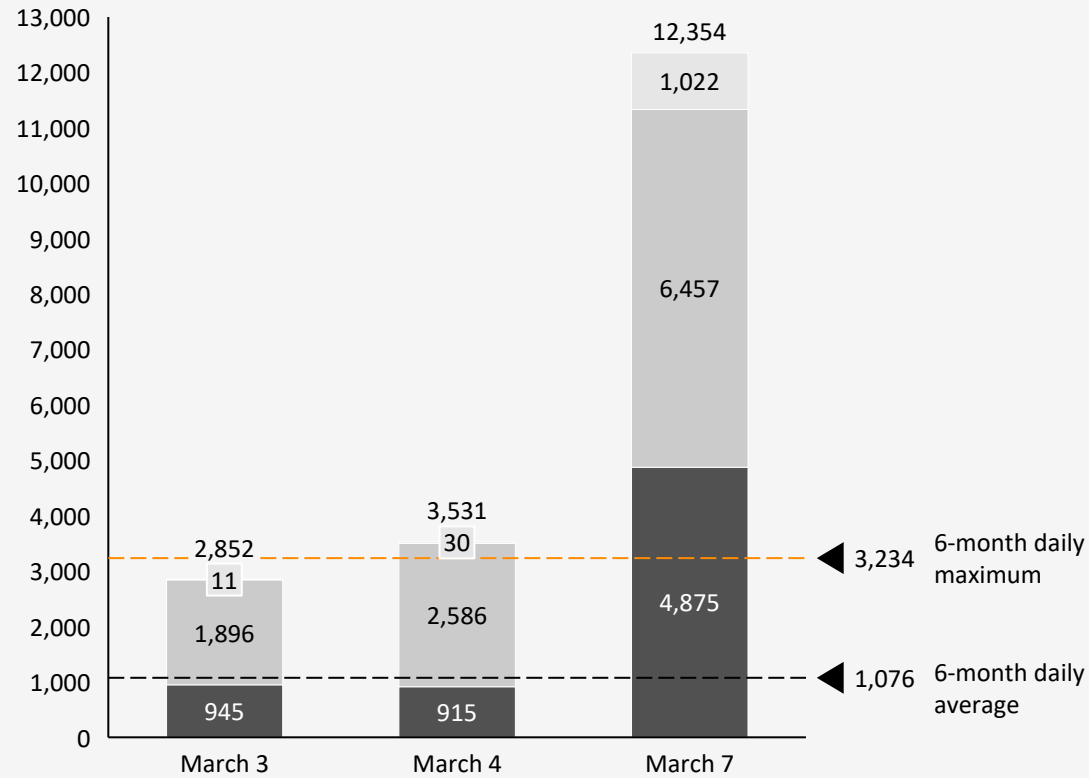
By the time LMEselect closed at 19:00, nickel was trading at \$50,300/t, up 69% from open. Measured on a 20-year timeframe, this was a twenty-five standard deviation price move, and over three times the largest price move it had ever experienced. This was in stark contrast to other major metals, including aluminium, which ended March 7 down 4.3%.

Following the suspension of intraday margin calls at 13:30 GMT, all outstanding exposure was rolled into the overnight margining run, with a further \$4.9bn instructed and settled before 09:00 the following morning.

Since the start of trading on March 4, prices had nearly doubled, and members had posted nearly \$16bn in margin on exchange positions to LME Clear. At least one member posted margin beyond its known pre-event liquidity, implying members may have been taking extraordinary steps to meet margin obligations.

1. Two of the four were less than five minutes delayed and a third was 25 minutes delayed. The fourth was unable to settle its calls by the end of the day.

Exhibit 10: ETD margin calls generated, \$m
(March 3–7)

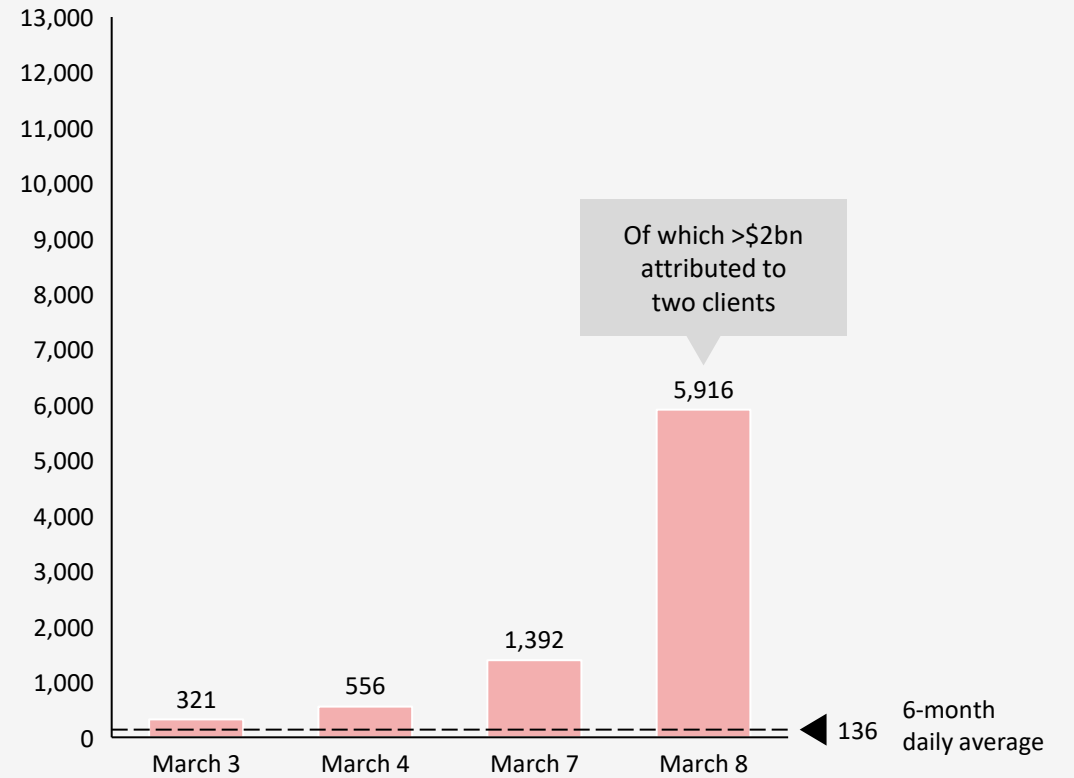


Margin settled

- After required timeframe
- Intraday within required timeframe
- In EOD process (before 9am following day)

Source: LME Clear margin call data

Exhibit 11: Missed OTC client margin calls, \$m
(March 3–8)



Source: Member data submissions to independent review

Price surge

March 8, 01:00 – 08:15

Following early morning media reports containing market rumours about member liquidity challenges and missed margin calls, the nickel price increased to over \$100,000/t before retracing to around \$80,000/t.

Just after midnight, a media report¹ flagged market rumours that an LME member was given additional time to pay ‘hundreds of millions’ of dollars in margin calls missed on March 7 due to non-payment by one of its clients. This reinforced the perception amongst market participants that the events in nickel were seriously affecting member liquidity.

LMEselect opened at 01:00 with the traded price at \$50,000/t and remained at that level for the first hour of trading. With the market still heavily bid and very limited competitive sell orders, however, prices began to rise from around 02:15. While order book depth appeared to increase, this was largely driven by highly speculative asks at around \$100,000/t that were at that point distant from the best ask offer, and were withdrawn by 05:15.

The price crossed \$60,000/t at 04:49, then \$70,000/t at 05:44. Then, in 24 minutes between 05:44 and 06:08 – the traded price of the 3month LME nickel contract rose to \$101,365/t. Prices had risen nearly \$30,000/t, or 44%.

While volumes were not markedly higher than in other periods, incremental buy orders in the early morning had an enormous impact on the price. The average price impact of trades (see exhibit 12) between 05:30 and 06:00 was over \$225/t, and bid-ask spreads on LMEselect reached \$5,500/t. Almost a thousand lots traded at a price over \$95,000/t between 06:00 and 06:26.

The two main buyers that had been risk-reducing during the run-up, both stopped placing orders as the price crossed \$100,000/t. Following this pause in short-covering, the price fell back to \$80,010/t in 7 minutes, by 06:33.

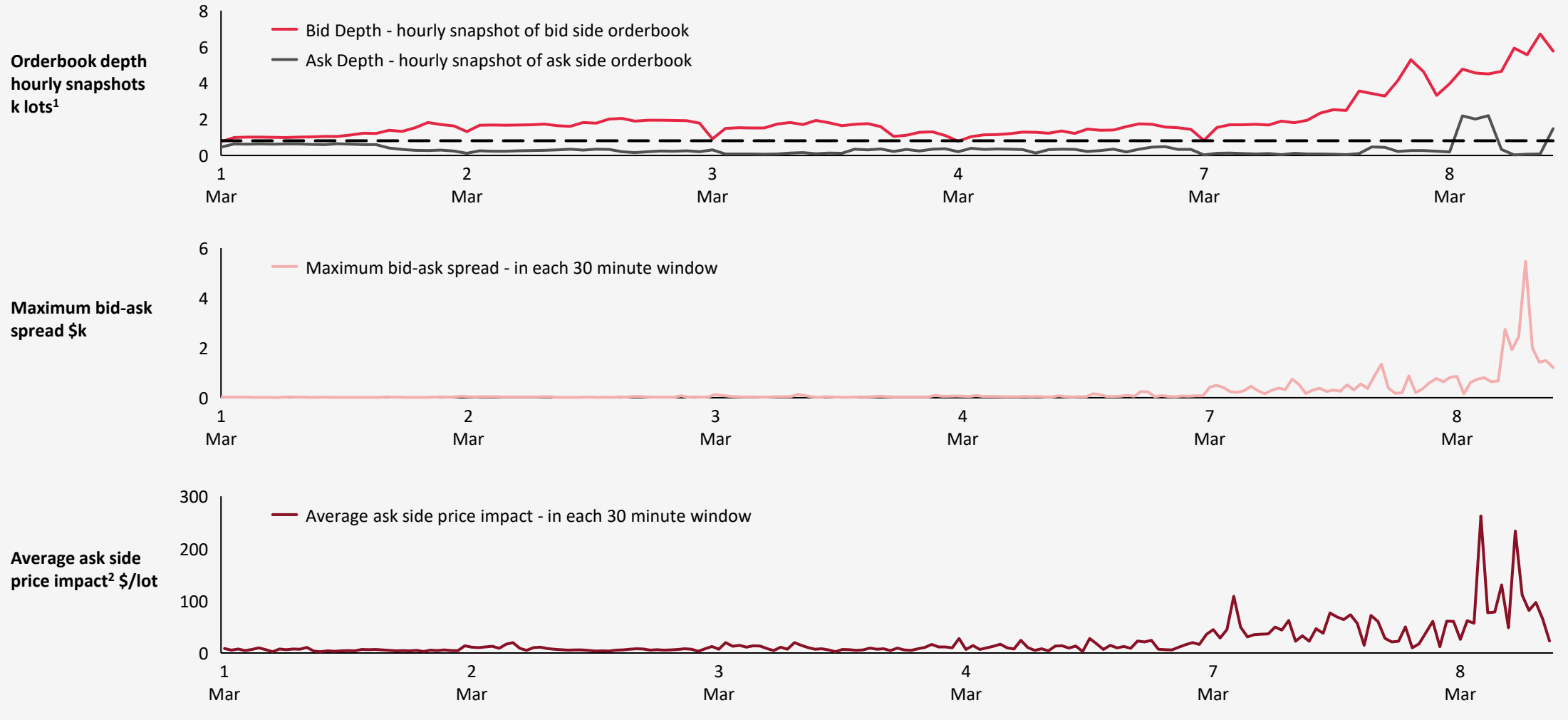
While net short covering through the morning only amounted to around 1,400 lots, the price impact was so high that prices accelerated even further. The price then traded around \$80,000 until the session was suspended. A small volume of asks and profit-takers came back to the market, enough to support a modest amount of further short covering by one of the firms that stopped at \$100,000/t.

While no margin was called by LME Clear on the morning of March 8, due to the suspension of the market, the system did automatically calculate variation margin calls that were never instructed for \$19.75bn in fresh mark-to-market losses from the morning’s trading alone.

1. Bloomberg, “China Construction Bank Gets Reprieve on Metal Margin Calls”

Exhibit 12: Indicators of liquidity on 3month nickel on LMEselect

March 1–8



Source: LME data

1. All orders included, including those further away from the best bid/ask; 2. Difference between the traded price set by an aggressing buy order and the best ask 0.001 seconds later

Summary of buying activity

Over March 4 - 8, outright buying on LME venues was mostly driven by participants exposed to large short positions.

House accounts made up 46% of outright buying activity on-exchange. Member trade data collected as part of the review shows this was a mix of members allowing

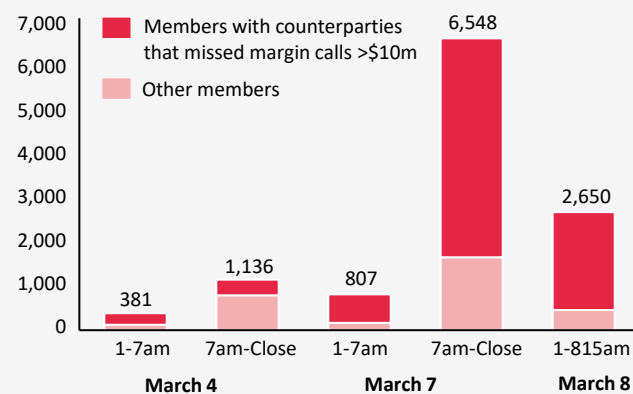
OTC counterparties to close short positions, and other members closing their own hedges, potentially anticipating an OTC counterparty default. More than half of outright buying on house accounts was by five members who each had over 5,000 lots of exposure to the five largest shorts in the market. Nearly three quarters of buying was by members with clients who had missed margin calls over \$10m with them during February and March 2022 (see exhibit 13). These clients were predominantly those with large short nickel positions.

Physical clients made up another 36% of outright buying, including a substantial portion of net buying on March 4. Of this, over 80% was closing out short positions held on-exchange (i.e. centrally cleared). One of the clients closing out positions on March 7 also had significant short OTC positions. They were a counterparty for – and missed large margin calls to – many members who bought on their house accounts during the events.

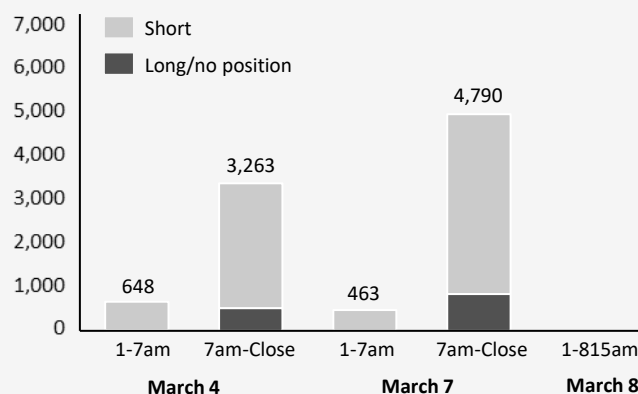
Financial clients made up the remaining 18% of outright buying activity. Of this around 40% were clients closing out short positions, with 60% being new or extensions of long positions.

Exhibit 13: Outright buying across all LME venues and nickel contracts, lots
March 4–8

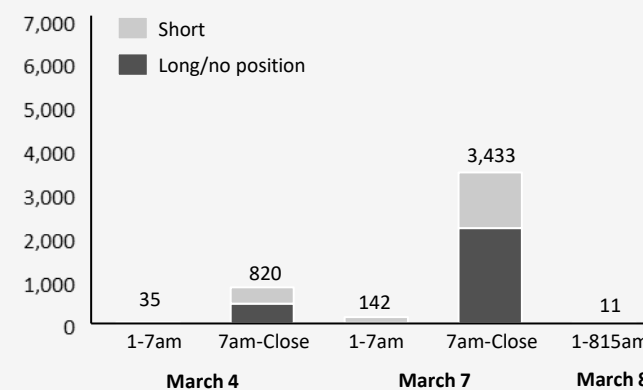
House accounts split by counterparty missed margin calls



Physical clients² split by position on-exchange prior to March 4



Financial clients² split by position on-exchange prior to March 4



1. Includes all members exposed to counterparties who missed margin calls of at least \$10m to them in February and March 2022. 2. For definitions of physical and financial clients see glossary
Source: LME data, member data submissions

Comparison to similar previous events

Events like those seen in the nickel market – where large price moves are caused by client or member distress – occur rarely, but it is possible to draw lessons from them.

Historically, the most frequent cause is one or more parties building-up large positions that end up on the wrong side of a major market move, and where there is insufficient protection against a major client default. The positions have tended to be speculative and beyond the financial strength of the counterparty. Major client and member defaults have resulted, and in three of the cases profiled the exchange has failed. Learnings from these events were incorporated into many of the practices now applied by exchanges and clearing houses, including margining practices, and creating robust default funds.

Less frequently, market distortions have been caused by technical issues, for instance when physical storage ran out at Cushing in 2020, causing front-month WTI oil prices to turn negative.

Compared to previous events driven by anything other than technical market issues, the events in nickel were notable for their speed and size – a 270% price increase over the full forward curve in less than three full trading days is unprecedented in a major commodity in recent times.

Exhibit 14: Examples of historic price distortions

Event drivers	Description (<i>Contract – Exchange – Year</i>)	Price move
Large positions or attempts to corner the market coupled with insufficient protection against major default	Palm Oil – Kuala Lumpur – 1984: A market participant built large short positions with 6 members. Facing a rising market and short positions due for physical delivery they unsuccessfully tried to buy back their position, rapidly driving up market prices. The market was suspended and 6 members defaulted. There was no default fund, and the exchange was eventually permanently closed	\$435/t to \$1,300/t
	Soybean – CBOT – 1989: Italian processor Ferruzzi tried to corner the market buying large physical stocks and taking large forward positions – 23m bushels for July (40% open interest). CBOT issued emergency order forcing all players to reduce to 1m bushels, causing prices to fall 5% in 2 days, and causing serious losses for Ferruzzi	(5%) over 2 days
	Index Futures – Hong Kong – 1987: Three participants held over 50% of open long positions. Index prices fell after Black Monday (October 19), leading to a suspension of the market. When it reopened on October 26, futures prices fell 44% in a day. 45 participants defaulted as clients failed to pay margin. The exchange was later rescued by the government	(44%) over 7 days
	Silver – COMEX – 1980: The Hunt brothers attempted to corner the silver market, stockpiling deliverable metal and causing prices to rise >700% in a year. The exchange intervened to restrict purchases of commodities on margin. When prices fell rapidly as a result, the Hunt brothers could not service margin calls and eventually went bankrupt	(50%) over 4 days
	Sugar – Paris – 1974: Nataf, the largest member of the French sugar exchange, built a long position equal to 56% of open interest on behalf of about 600 retail traders. Prices crashed, hitting trading limits on 7 days, and after 4 days Nataf failed to pay VM. The market closed after 11 days with 6 members about to default. The CCP had no default fund and failed as a result	(21%) over 11 days
Technical market issues	WTI Crude – NYMEX – 2020: Demand for oil fell sharply during Covid-19 pandemic, so oil storage facilities at Cushing, the delivery hub, were completely full. The need for physical delivery into expiring contracts could not be met, leading holders of long positions to offload at any price. Front month prices went negative but had a limited impact on the forward curve	\$18/bbl to -\$37/bbl within hours
	VW Equities – Frankfurt – 2008: Porsche attempted to perform a reverse takeover on its parent, VW. It bought outright shares and, unknown to the market, a significant amount of cash-settled options in VW – taking its ownership up to ~74%. Hedge funds were therefore unable to repurchase ~12% of shares outstanding that were sold short, with only ~6% available freely, leading to a 5x price spike	€210 to €1,000+

Source: Public sources



Contributing factors

Introduction to the contributing factors

The previous section described the events in nickel in March 2022 and the elements of what became a short squeeze. This section identifies the factors that contributed to the events.

The factors analysed include underlying risks, processes and controls, and market structure, and whether they drove, exacerbated, or failed to mitigate the events. In line with its scope, this review did not look at decision-making and governance at LME Group.

Large short positions had been in place in the market for many months that then became exposed during the events in March. Two contributing factors combined were responsible for this:

- **Fragmentation of positions across counterparties and between on-exchange and OTC markets reduced visibility of risks.** Some of the biggest positions in the nickel market were distributed across a large number of counterparties and venues (OTC and centrally cleared), reducing visibility of the levels of concentration and therefore the levels of risks associated with them.

- **Position limits and accountability levels did not prevent the build-up of large, exposed positions.** The size of positions in the nickel market are limited by regulation and are also reviewed within the LME's accountability levels framework, which permits the LME to request information from members about positions which meet certain quantitative criteria. Neither of these prevented large positions from building up. The calibration of regulatory limits – which cover both on-exchange and OTC positions – was too high to place practical restrictions on trading activity. The LME sets accountability levels for each prompt date and for net positions on its venues, beyond which users can be asked to provide a rationale. Overall, this process did not provide the LME with the information needed to identify the build-up of large, exposed positions in the OTC and ETD markets.

The fall in willingness to provide liquidity is observable prior to the initial price dislocation on March 4. This element of the squeeze was related to inherent aspects of the nickel market and the market context at the time:

- **Nickel is known to be volatile, prone to distortion, and exposed to geopolitical risks.** Participants are wary of the nickel market, which is relatively small and historically one of the most volatile. Regional patterns and production innovations can affect the pricing outlook rapidly. A larger proportion of nickel

is produced in Russia than other metals, even more so when considering just the nickel deliverable on the LME, making it particularly exposed.

- **The market believed there was pressure on large short positions.** Public reporting of market rumours in February 2022 suggested that the holders of large short positions were under increasing pressure, with commentary already describing the beginnings of a short squeeze. In addition, nickel stocks in LME warehouses (and other metals) had been falling for months and the market was considered increasingly tight.
- **Absence of a diverse range of participants willing to take opposite positions.** There were relatively few participants able and willing to profit-take as the nickel price rose, with various aspects of market structure seen as deterring participation on the exchange.

The withdrawal and absence of liquidity led to outsized impacts of trading from March 4 onwards and price acceleration. This in turn triggered record margin calls, further increasing pressures on major short positions. Two factors contributed to the price spiral:

- **The LME's price volatility controls did not control price volatility during the events.** While the LME had controls in the form of dynamic and

static price bands, they did not ultimately stop the run-up in prices. Effective volatility controls could have provided market participants with time to reflect, secure financing, or seek ways to manage large positions off-exchange.

- **Eventually, market participants perceived that members may have been insufficiently robust to withstand the events.** In particular, media reporting of market rumours overnight on March 7 claiming a member had failed to pay a margin call was seen by participants as adding to market pressure. Members in fact met margin calls of nearly \$16bn over the period. Nonetheless, unique aspects of the LME Clear model – including mechanisms that support credit provision to clients – and the composition of the membership can give the perception that the clearing system is less robust than elsewhere.

Participants exposed to short positions, both the end users and their OTC counterparties, came under increasing pressure and started buying on LMEselect to close out positions. Some of this desire to reduce risk, and the consequences of that risk reduction can be attributed to:

- **Basis risks emerged from the use of LME nickel prices to hedge sales based on Class 2 prices.** Producers of Class 2 nickel often rely on LME nickel

prices (which are for refined nickel) to hedge their production, which they may sell based on local market prices decoupled from the LME price. As LME nickel prices rose rapidly, producers with such hedges faced risks to the solvency of their businesses due to increasing basis risk. This may have increased pressure on them – and their OTC counterparties who had hedged exposure on the exchange – to wind down short positions in the market. It may also have made it more challenging to raise finance to meet margin call obligations.

- **There was no well-rehearsed approach among members to close-out significant positions.** As participants sought to close out short positions to reduce the risks growing in step with prices, they attempted to cover their positions directly on the exchange. As such, the close-out strategies of certain members effectively exhausted market liquidity during the events.

The rest of this section provides more detail and analysis behind each of the contributing factors.

Exhibit 15: Summary of contributing factors

The existence of large, exposed short positions:

- Fragmentation of positions across counterparties and between on-exchange and OTC reduced visibility of risks.
- Position limits and accountability levels did not prevent the build-up of large, exposed positions.

The withdrawal of liquidity:

- Nickel is known to be volatile, prone to distortion, and exposed to geopolitical risks.
- The market believed there was pressure on large short positions.
- Absence of a diverse range of participants willing to take opposite positions.

The price acceleration and resultant margin calls:

- The LME's price volatility controls did not control price volatility during the events.
- Eventually, market participants perceived that members may have been insufficiently robust to weather the events.

Rapid risk reduction by participants:

- Basis risks emerged from the use of LME nickel prices to hedge sales based on Class 2 prices.
- There was no well-rehearsed approach among members to close-out significant positions.

The fragmentation of positions across counterparties and venues reduced visibility of risks

LME Group and market participants were not able to fully assess the risks associated with large short positions, which were fragmented across multiple counterparties and sometimes between OTC and on-exchange positions.

The largest short positions were held by a range of different company types, including diversified producers and traders, and more specialised players with greater exposure to nickel. For producers, short positions usually equated to less than a year's production, which is not an unusual hedging strategy for a producer (noting that some of the largest nickel consumers hedged much further ahead, including beyond 5 years).

Several of the largest beneficial owners held positions with multiple members, in one case as many as twelve. On average, the ten largest short positions were held across five members.

In terms of venues used, two of the largest ten short positions were exclusively on-exchange, five had both OTC and on-exchange components (with on average 52% being OTC), and three were exclusively OTC. All bar

one of the OTC positions were spread between multiple members.

For more than one beneficial owner, notional losses by early March would already have been significant relative to their total reported equity. These beneficial owners held the majority of their positions OTC, and included one of the clients with a significant OTC component fragmented across counterparties.

At least three of the ten largest short position holders were overdue on margin toward a subset of members when prices accelerated on March 7. By the close of trading on that day, those overdue margin amounts had increased significantly, particularly on OTC positions, and payments had become overdue to a greater number of members.

As set out in description of events, risks in the OTC market then appear to have spilled over to the exchange as members counterparty to the OTC positions seemingly managed risks through buying on LMEselect.

The fragmentation of positions is believed to have reduced the visibility of risks and made them more difficult to manage. For instance, LME Group management stated that when risks around specific large positions were evaluated, the presence of a large on-exchange component created an impression that it constituted the entirety of that beneficial owner's

position when in fact there was a larger position held OTC. One member also stated that the lack of transparency over the true extent of beneficial owner positions made it more difficult for them to appropriately manage their risk appetite.

Position limits and accountability levels did not prevent the build-up of large, exposed positions

The calibration of regulatory position limits and the enforcement of the LME’s accountability levels did not prevent large, concentrated positions from building up.

There are two kinds of controls on the size of positions in the nickel market: MiFID II regulatory position limits, and the LME’s accountability levels, which are thresholds at which participants can be queried to provide an economic rationale for the size of their position and be compelled to reduce it. Regulatory position limits apply across OTC and exchange trading whereas LME accountability levels were limited to exchange-traded positions, including for house accounts, which typically have offsetting hedge positions for large client OTC positions that are not netted internally.

Some market participants felt regulatory position limits did not set any real restriction on trading activity as they were perceived as extremely high relative to the nickel market size and volumes, and given their understanding that regulatory limits did not apply to many OTC positions. The limit on client positions for contracts in the spot month is 25,150 lots (over 150kt), and in other months (including the 3month contract) is 80,200 lots (over 480kt).

This meant that none of the largest positions in nickel in March 2022 would have breached regulatory position limits. Whilst it reserves the right to do so, the LME does not apply its own binding position limits on its venues.

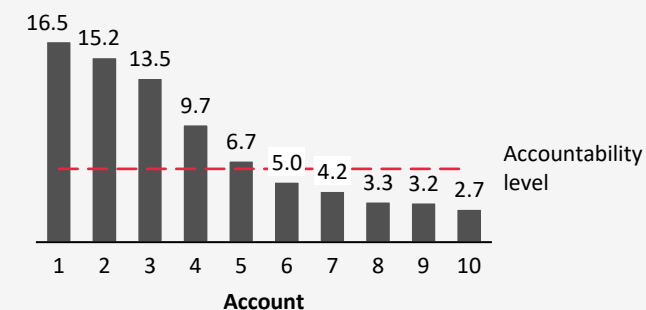
The LME manages risks associated with large positions through its accountability levels framework. For nickel, these were triggered if positions in either a single prompt date, or the net position across all prompts, exceeded 6,000 lots (36kt). It is at the LME’s discretion whether to follow up on user accountability level excesses and it has typically done so on single prompt breaches rather than where a net position exceeds the threshold. This has not historically led to users being asked to reduce positions. LME management stakeholders explained that the LME is concerned with participants building up dominant positions at set points in the curve in order to corner the market for that prompt date.

In the lead-up to March 2022, single prompt date excesses were routinely followed-up. These were individually small and did not lead to LME taking further action. However, LME did not routinely investigate large *net* positions exceeding accountability levels (as opposed to on a single prompt basis). This reduced the likelihood of identifying the scale of OTC positions giving rise to the excesses (through members’ house accounts) or assessing the need for any further risk reducing measures (exhibit 16).

Peer exchanges vary in how they set and enforce hard position limits and accountability levels. Hard net position limits which are set tighter than regulatory position limits are not a universal peer practice, but leading peers do apply hard limits in places. One market participant perceived that there is less discretion in the application of accountability levels on other venues, stating that they are more thoroughly interrogated on the nature and intent of large positions by other exchanges.

Systematically and thoroughly following up on net accountability level excesses could have allowed the LME to identify significant OTC exposures being run by multiple members.

Exhibit 16: Net position of top-10 short beneficial owners on exchange
k lots, March 4



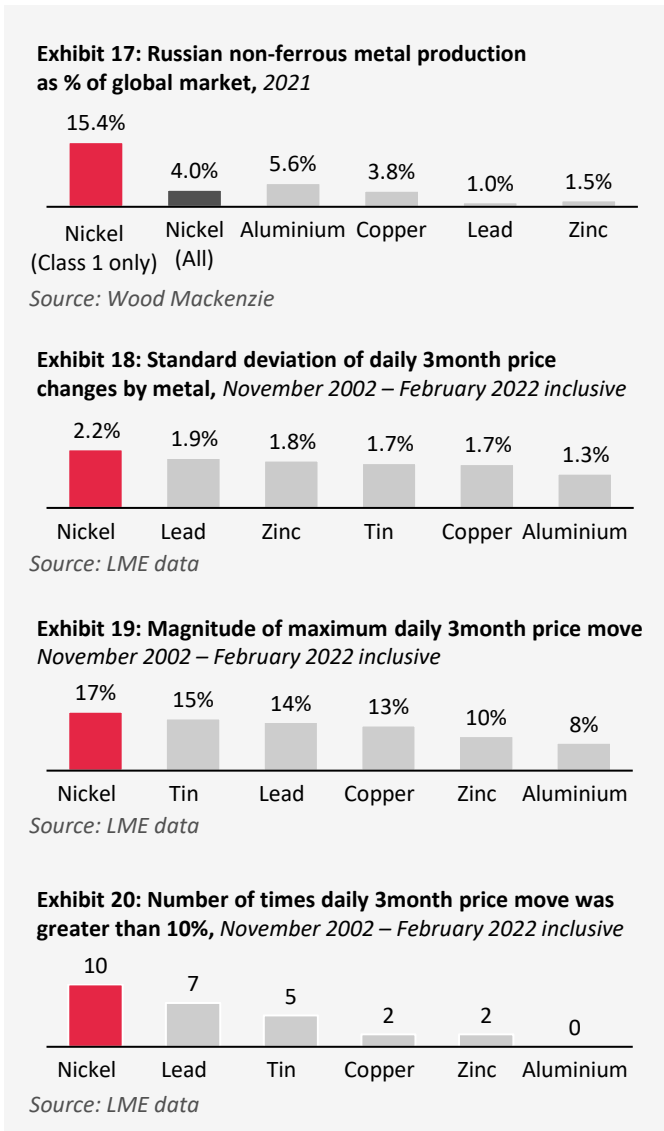
Source: LME data

Nickel is known to be volatile, prone to distortion, and exposed to geopolitical risks

Nickel is a relatively small and historically volatile market, exposed to specific geopolitical risks concerning Russia. This context combined with Russia’s invasion of Ukraine may have made participants wary of the possibility of sudden moves in March 2022.

Nickel is prone to extreme market moves. Over the last 20 years, nickel daily price volatility has been by far the highest of LME’s major metals being, for example, 67% higher than aluminium. Nickel has historically seen large daily price moves, the highest gain being 14% on 29 October 2008 – and more frequently sees daily price moves of over >10% than other metals do. Nonetheless, nickel is a generally liquid contract with sufficient volume and interest that, prior to March 2022, the bid-ask spread on LMEselect was a relatively tight 7bp¹.

However, Russia’s invasion of Ukraine led to fears of sanctions similar to those that had been applied against aluminium producers in 2018. These fears were most acute in nickel due to its exposure to Russian production. The combination of a historically volatile market with the potential for large geopolitical risks may have dissuaded participation and liquidity provision in March 2022.



The market believed there was pressure on large short positions

Media reports of market rumours in February 2022 suggested that there were holders of large short positions in nickel that were under increasing pressure, with commentary already describing the beginnings of a short squeeze.

An article on 14 February 2022² specifically claimed that a single producer had ‘amassed large short positions’ and that they might be ‘on the losing side’ of the trade. The majority of market participants believed these reports were credible.

On top of these reports, nickel stocks in LME warehouses (and other metals) had been falling for many months and the market was considered increasingly tight, with risks of a delivery crunch also apparent. Market rumours of concentrated warrant-holdings further contributed to this perception of market tightness.

As prices continued to move upwards following February 24, market participants have described being wary of risks building up in the market and of positioning on the wrong side of potential price moves.

1. Normalised bid-ask spread between September 2021 and February 2022; 2. Bloomberg, “Trader Known as ‘Big Shot’ Battles Mystery Nickel Stockpiler”

Absence of a diverse range of participants willing to take opposite positions

There were relatively few participants able and willing to take opposite positions as the nickel price rose. Even on March 8, as prices rose to over \$100,000/t, profit-taking by financial participants¹ amounted to only around 100 lots – this lack of selling interest contributed to the order book imbalance throughout the events.

The LME’s market structure has been subject to ongoing debate as to whether it promotes or reduces participation and therefore liquidity. LME Group has proposed a series of reforms to its market structure, in the Strategic Pathway 2017 and Strategic Pathway 2020 papers, many of which would move the LME to a model more consistent with global peers, with the aim of encouraging further participation. Changes proposed over the years include:

- Closing the Ring and moving to a purely electronic trading venue.
- Fee structure reform to support trading-only membership and a clearer distinction between traders and clearers.
- Reforms to the clearing model, predominantly shifting away from DCVM and implementing VaR-based initial margining methodology.

- Concentrating liquidity in a monthly contract and moving away from a daily prompt date.
- Allowing end-clients full access to the central limit order book, supporting a larger liquidity pool.

Much of the feedback given to the independent review on the role that the LME’s market structure played in the events in nickel was aligned with existing views on the desirability of some of these reforms. Proponents of the existing system highlight that it delivers a high degree of functionality for physical participants, including a daily cash price, the ability to hedge production to a particular day, and that it facilitates greater levels of access and credit provision.

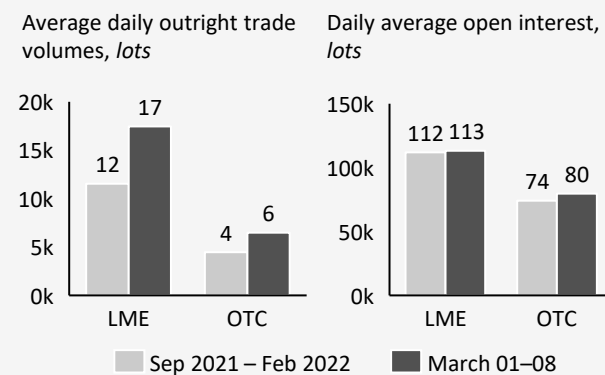
Proponents of change believe that existing participants would gain efficiency benefits from harmonising the LME structure with other venues, and that the current structure deters new participants due to its complexity and an aversion to some of the margin practices (including the retention of profits until settlement by clearing members under DCVM). These participants felt that aspects of the LME’s structure are not conducive to maximising the depth of liquidity on its venues.

There is a significant OTC market in metals (exhibit 21). The daily outright traded volumes on OTC markets were approximately a third of LME traded volumes. Much of this volume is executed on single dealer platforms.

OTC volumes are often netted by members before being hedged on the exchange. The fragmentation of liquidity pools was highlighted by participants as reducing their ability to understand the true level of market liquidity, reducing their confidence in entering into positions.

The independent review does not consider any specific aspect of the LME’s market structure as having caused the events in nickel. Nevertheless, LME Group now have to address challenges around rebuilding liquidity, and they will need to get the balance right between measures to increase liquidity by attracting new participants, while also maintaining the presence of the physical participants.

Exhibit 21: Breakdown of nickel trading by venue



Source: LME data, member data submissions

1. Definition of physical participants includes producers, consumers and merchant traders, while financial participants include banks and investment funds

The LME's price volatility controls did not control price volatility during the events

LME price volatility controls did not prevent unprecedented nickel price moves. A less rapid price increase would have been easier for the LME and members to manage, which could have softened price distortions. Volatility controls are common market practice among peer commodities exchanges, and the majority of market participants highlighted that in their view the lack of sufficient volatility controls was a key contributing factor to the events.

The magnitude and velocity of the increase in nickel prices was unprecedented. A counterfactual of events where price volatility controls were in place is hard to develop, and market participants held differing views on what might have occurred. A few participants believed volatility controls could have avoided the event entirely – while many others took the view that they would have helped to slow the pace of the events and provided the market with 'breathing room', which could have prevented the price rising to such extreme levels. Some disagreed, contending that the same price rise would have taken place, simply over a longer period of time. The consensus view was that slowing the pace of the events, with or without the same level of price

increase, would have been preferable to what actually occurred in March.

Precise implementations of price volatility controls vary by exchange and by market, but volatility controls typically consist of multiple layers – focused on a range of latencies. These prevent undesirable market distortions from occurring so rapidly that market participants do not have time to properly consider their next actions. Typical practices at peer exchanges include:

- Controls to prevent 'fat finger' events, e.g. 'dynamic' price bands that update very rapidly, triggering a hold period if a contract breaches a set range in a very short time window.
- Controls to prevent 'runaway' herding activity, e.g. 'circuit-breakers' or 'velocity logic' that temporarily halt trading for a number of seconds or minutes if markets move too quickly by exceeding a certain range during a given lookback window.
- Longer breaks or trading constraints, in the form of 'price limits', or 'trading halts' (pausing or restricting trading to avoid prices moving too far in a trading session), to allow inactive market participants to enter the market with liquidity, existing participants to secure liquidity, funding for margin calls, or for possible intervention or investigation by the market operator.

Prior to the events of March 2022, the LME had controls in place, in the form of dynamic price bands (to prevent fat-finger events) and static price bands to prevent significant moves hour-on-hour.

However, the LME's static price bands ultimately did not stop the run up in nickel prices witnessed between March 4 and March 8.

The LME did not have circuit breakers or longer-term, e.g. daily, price bands or limits to restrict or halt trading for longer periods. In this instance, the independent review believes that where price increases were driven by short-closing in thin liquidity, longer halts to trading would have been the most helpful.

They would have allowed participants to seek internal approval for longer-term contrarian trades that could have provide much needed liquidity, source and convert liquidity from overseas parent entities, or agree financing to support margin calls and prevent client positions being closed out (to the extent any of those options were available).

Eventually, market participants perceived that members may have been insufficiently robust to withstand the events

Media reporting of market rumours overnight on March 7 claiming a member had failed to pay a margin call was seen by participants as adding to market pressure. Members in fact met margin calls of nearly \$16bn over the period. Nonetheless, unique aspects of the LME Clear model – including mechanisms that support credit provision to clients – and the composition of the membership can give the perception that the clearing system is less robust than elsewhere.

LME Clear's margining approach allows General Clearing Members (GCMs) who clear on behalf of clients to offset margin requirements between clients through the use of Net Omnibus Segregated Accounts (NOSA) and Discounted Contingent Variation Margin (DCVM).

NOSAs reduce the margin requirement for GCMs by calculating margin on netted client positions within the same account. By reducing margin payable to the CCP, GCMs can potentially take on more risks, as they can use the offsets to extend credit to clients, thereby increasing leverage. Members who were short in nickel

across both house and client accounts generated >\$2bn in NOSA margin offsets from all metals ahead of March 2022. Members were typically able to pay between 60% and 80% of gross client initial margin as a result of this netting.

The DCVM margin approach means mark-to-market profits from profitable clients can be used to reduce margin payable to the CCP. Across all members with clients net short in nickel, a maximum of \$915m in offsets were generated in the six months prior to March 2022. Of these offsets, 95% were generated within accounts at members who were large global banks with over \$10bn in market capitalisation, indicating that DCVM credits, in reality, were unlikely to have made members less robust during the events.

LME Clear's unique and distinct membership base comprises more unique and smaller GCMs than is typical for other commodities CCPs (roughly half of LME Clear GCMs have less than \$1bn of total equity). Many of LME Clear's unique and smaller GCMs trade at other commodities exchanges as Non Clearing Members (NCMs), which is less attractive on the LME predominantly due to the fee structure. Smaller GCMs may be less resilient to withstand extreme events and adverse market movements, particularly if they are thinly capitalised in relation to the positions and leverage their clients have.

Some market participants highlighted that they perceive LME Clear as less robust due to the combination of its unique membership composition together with a margining model that facilitates the provision of credit to clients. This perception of member weakness may have meant that media reports of a missed member margin call in the early hours of March 8 had more severe consequences than would otherwise have been the case by exacerbating the withdrawal of liquidity.

While such perceptions may have impacted the course of the events in nickel, all LME Clear members fulfilled margin obligations within 24 hours on March 7, a day where the price move far exceeded stress test scenarios and historical observations (the nickel price move on March 7 was 69% compared to the largest move over the previous two decades, 17%, and the ESMA 2019 stress test scenario, 23%).

It should also be noted that, while highlighting certain risks, the independent review does not, and the majority of market participants did not believe the LME Clear member model directly caused the event, or that another margining approach, e.g., Realised Variation Margin (RVM), would have materially changed the course of events.

Basis risks emerged from the use of LME nickel prices to hedge sales based on Class 2 prices

The use of LME nickel prices to hedge against Class 2 nickel can give rise to short-term basis risks if that production is sold at prices that decouple from the LME price.

Producers of NPI (a Class 2 nickel) have no futures market on which they can hedge their price risk directly. Consequently, some choose to use the LME to hedge forward price risk. Exhibits 22 & 23 show the historical prices of LME nickel and the Shanghai Metals Market

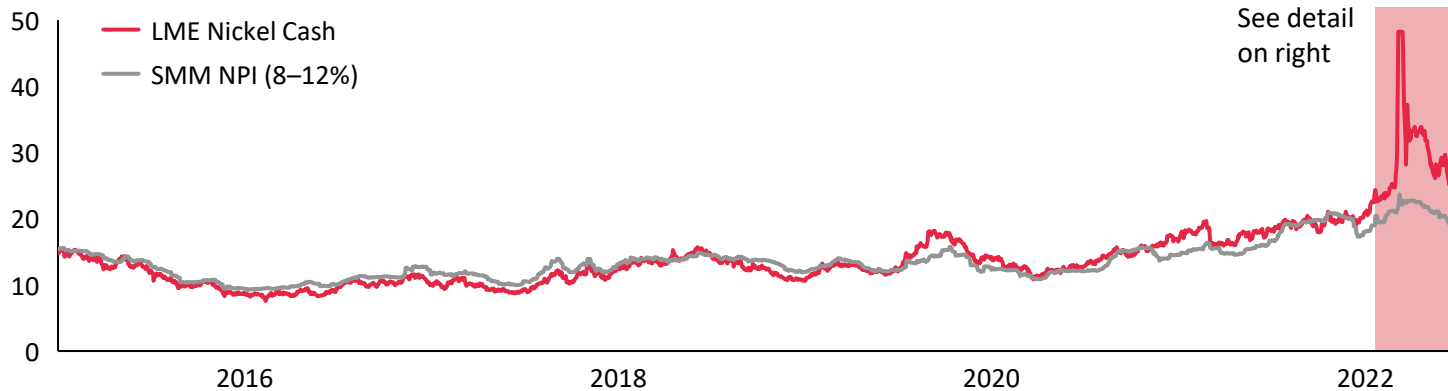
(SMM) price index, a published price index for NPI. Historically, these prices have tracked each other fairly consistently.

By March 3, with the LME price rising on fears that sanctions on Russia would interrupt over 20% of the supply of Class 1 nickel, a spread of \$6,700 had opened up against the SMM NPI 8–12% price. If sanctions had been imposed, this spread could have increased.

Any exposure to this basis risk would have created sizeable losses, with losses on LME hedges not matched by a corresponding increase in sales priced on NPI indices. Contracts for Class 2 nickel priced using LME refined nickel may also have become difficult to enforce.

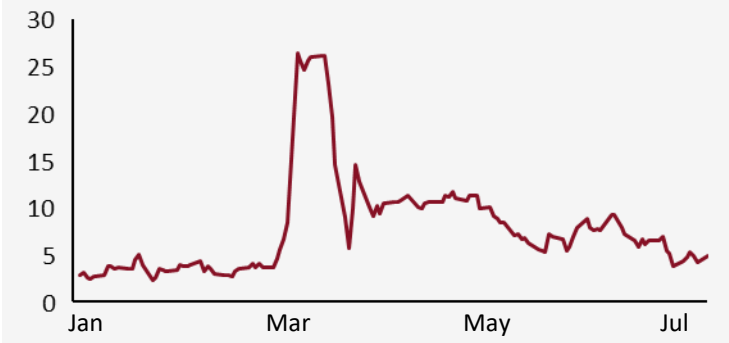
The immediate issue for producers with hedges in early March was a liquidity challenge as they sought to fund rapidly rising variation margin requirements, regardless of how well matched hedges were. Depending on the extent of their exposure, solvency concerns due to basis risks could also have hampered clients' ability to raise additional funds to pay variation margin calls.

Exhibit 22: LME nickel compared to SMM NPI (8-12%), \$/t of Nickel 2015–2022



Source: LME data, SMM

Exhibit 23: LME nickel - SMM NPI (8-12%) premia, \$/t of Nickel, 2022



There was no well-rehearsed approach among members to close-out significant positions

The market as a whole was not well prepared to respond to large client defaults, particularly where they could impact OTC trades and multiple counterparties. This led to certain members seeking to cover their positions directly on the exchange, exhausting market liquidity and exacerbating liquidity withdrawal due to the uncertainty on what the total close-out interest was.

Members are responsible for the margin obligations of their clients and any defaulted client portfolios, whether OTC or ETD. Client default is a key risk factor for members and can lead to market distortions if positions being closed exhaust market liquidity.

While LME Group was not notified of any formal client default during the events (i.e., between March 3 and March 8), large member-client margin payments were missed, and multiple members sought to close out positions simultaneously. As events transpired, any efforts to close out positions off-exchange appear to have been insufficient, and significant close-out interest therefore flowed into the LMEselect order book. In turn this impacted other market interests, further

exacerbating the shortage of ask-side liquidity due to the uncertainty of the total close-out interest, and thus how high prices could go.

Approaches to manage client default vary among commodities exchanges and clearing houses – practices that are employed include:

- Requirements for members to have clear default management processes and playbooks in place considering the type of client exposures they are running.
- Requirements for members to regularly test the client default management process, e.g., through ‘fire drills’.
- In-depth reviews of the member default management practice as part of the member onboarding process, including periodic assessments and follow-ups.

In the nickel market, effective client default management would require members having well-rehearsed approaches to unwind default portfolios both on and off the exchange. Unwinding defaulted portfolios off exchange requires that members have ways to connect with market participants that have the balance sheet (or natural long/ short interest) to manage the unwinding of defaulted portfolios in an orderly fashion. This can include netting against large open OTC positions at an agreed premium, or selling it to market participants that have speculative interest and the ability to bear

market and liquidity risk, at least in the short-term.

The next section of the report goes on to describe a set of recommendations to the LME and LME Clear, given the analysis of events and the contributing factors identified here.

Recommendations for the LME and LME Clear

Introduction to the recommendations

This section lays out recommended objectives and measures that the independent review believes would reduce the likelihood and impact of events similar to those that took place in nickel in March 2022, if implemented by LME Group.

The review defines similar events as severe market distortions, with extreme price movements or high levels of volatility at a time with no or limited new information on the asset being traded. This includes delivery crunches, short squeezes, or attempts to corner a market, often involving a price spiral and forced trading behaviour driven by margin pressures.

The recommendations introduce layers of defence that could improve LME Group’s ability to identify, prevent and manage risks of market distortions. They also include measures that could support the rebuilding of confidence in the LME market. In line with the scope of the review, the recommendations focus on tools, processes, and capabilities, and do not cover LME Group’s decision-making. Many of the recommendations are anchored in industry practice for building resilience against extreme events.

While the March 2022 events in the nickel market involved multiple stakeholders, the recommendations are limited to what is within the scope of the LME and LME Clear to consider implementing given their powers and role vis-à-vis regulators and members.

A principle followed is that LME Group is not directly responsible for prices on the exchange, which should be driven by market forces. Rather, the LME and LME Clear should have clear and transparent rules that they believe would prevent foreseeable causes of market distortions, recognising that these rules may influence the price but in a way that the market understands.

Some of the recommendations focus on spillover risks to the LME from the OTC market, which is sizeable and which the LME does not oversee or regulate. The recommendations focus on steps the LME Group, as operator of the centrally cleared market, could take to identify and manage foreseeable and material risks from the OTC market that can cause LME market distortions.

The involvement of the regulators of the OTC market will be required to align approaches, ensure responsibilities are clear, and to manage risks the LME does not have the legislative mandate to oversee.

The rest of this section lays out a set of objectives and suggested measures to support meeting the objectives.

Summary of recommended objectives for the LME and LME Clear

1. Extend the mandate of LME’s risk and control functions to explicitly cover identification and prevention of market distortions, and upgrade capabilities accordingly
2. Tighten LME rules and enforcement processes to prevent risks of market distortions
3. Monitor significant risks in the OTC market to manage risks of LME market distortions
4. Upgrade volatility controls to slow down extreme price moves
5. Build operational readiness across the market for managing extreme events
6. Consider tightening rules to improve perceptions of member and LME Clear resilience
7. Provide a clear vision for how the LME will respond to events and rebuild liquidity

Identify risks & prevent extreme events

Manage & control extreme events

Rebuild confidence

Objective 1: Extend the mandate of the LME's risk and control functions to explicitly cover identification and prevention of market distortions, and upgrade capabilities accordingly

1.1 Consolidate senior responsibility for identifying and preventing market distortions, including the creation and enforcement of rules and procedures (detailed in Objective 2).

1.2 Create, publish, and maintain a 'market distortion risk assessment' detailing the types of distortions considered possible on LME markets, to form the basis for monitoring and enforcement processes. Ensure the assessment covers a broad set of risks that can lead to distortions, including but not limited to risks of market abuse.

1.3 Delegate the responsibility of controlling risks of market distortions to appropriate functions and ensure that each function is resourced and equipped to take on those new roles. Build up expertise in underlying physical markets as well as practices in the OTC market to help understand the spillover effects onto the LME.

1.4 Upgrade the LME's analytics capability and design metrics that risk and control functions can use to effectively monitor market conditions and materialising risks, including but not limited to: LME order book quality and depth, cross-venue

trading patterns, and market participation changes (e.g., the prevalence and quality of two-way liquidity provision).

1.5 Improve forums for LME and LME Clear risk teams to share potential warning signals related to market conditions, members, and clients.

Upgrade communication channels with regulators and other exchanges to share concerns about warning signals and risk materialising, where appropriate.

Objective 2: Tighten LME rules and enforcement processes to prevent risks of market distortions

2.1 Review LME rules and enforcement processes to ensure preventative tools are in place for each of the 'foreseeable risks' of market distortions identified (Objective 1.2). Make enforcement processes better codified and transparent to the market, including but not limited to defining under what circumstances the LME will require market participants to: clarify trading intent or reduce positions (by advice or instruction), and when the LME might consider restricting or suspending market access, sanctioning participants with fines, or suspending the market entirely.

2.2 As part of this process, revamp the accountability level framework and introduce LME position limits for centrally cleared positions. Set LME position limits on single prompt dates as well as on the aggregate net

client position. Calibrate position limits based on the LME market size and traded volumes so that they become effective protection against speculative positions causing extreme price fluctuations. Discuss with the FCA how new LME position limits could best be aligned with regulatory limits applicable on the OTC market.

2.3 Apply strict rules for any hedging exemption to LME position limits. Exemptions should consider the financial resources of the participant and governance of the hedging policy, as well as the 'physical exactness' of the hedge in terms of e.g., geographical locations, prompt dates, the price basis used in physical contracts, and deliverability.

2.4 Consider if similar criteria should be used to decide if a member can exceed exchange position limits in order to hedge an OTC client position, which in turn is hedging physical production of the OTC counterparty.

2.5 To further reduce the likelihood of future delivery squeezes, adjust the LME lending rules to become applicable in a broader set of situations where warrant ownership is concentrated. For example, expand the threshold at which it becomes applicable, currently when one participant holds 50% of warrants, to include two participants holding over 70% of warrants.

Objective 3: Monitor significant risks in the OTC market to manage risks of LME market distortions

3.1 Identify risks from the OTC market that could cause LME market distortions as part of the risk assessment performed in objective 1.2. Periodically update the risk assessment through broad member OTC data requests to identify changes in OTC market dynamics (e.g., OTC market size, trading participants, liquidity, concentration, margining practices, credit extension and linkages to the centrally cleared market).

3.2 Develop member OTC notification requirements based on the above, that prescribes events members need to report to the LME. This likely includes position reporting above a materiality threshold and reports of significant missed margin calls. Develop analytics tools to effectively analyse the OTC notifications, including tools to aggregate data across members and centrally cleared markets. Engage members to prevent OTC risks materialising from spilling over to the LME market and prepare to manage potential events should they materialise.

3.3 Proactively engage with the regulators of the OTC market to ensure there is a shared understanding of risks, monitoring, and the tools available to manage any risks the LME is not well positioned to address given its role as the operator of the centrally cleared market.

3.4 Following the events, the LME has implemented a mandatory OTC position reporting regime which provides the LME with much increased visibility. The LME should use this data as part of its OTC spillover risk assessment and then make amendments to the reporting regime based on the assessment's conclusion.

Objective 4: Upgrade volatility controls to slow down extreme price moves

4.1 Build out the daily price band of 15% implemented by the LME since March, by:

- a) Setting price bands or limits for each metal guided by historical price data and different volatility dynamics. The price bands or limits should be set considering volatility controls at other exchanges trading similar commodities.
- b) Clearly defining circumstances under which the price limit would be adjusted or re-calibrated.
- c) Implementing trading halts over multiple days if limit up/downs occur on multiple consecutive days.
- d) Enhancing member communication channels to provide information on the state of the market (e.g. if the traded price has reached a tick below the price limit), preferably via direct electronic messages/APIs.

e) Clearly defining trading rules that apply during market halts and market re-opening. Clarifying the impact of limit up/down on related contracts (e.g., options).

4.2 Explain the broader set of volatility controls operated by the LME (e.g., dynamic price bands) and how price limits operate alongside these other controls. Review the operation and calibration of the dynamic price band, including how its use is communicated, alongside the upgrade to the price limit.

Objective 5: Build operational readiness across the market for managing extreme events

5.1 Develop a range of extreme event scenarios, building on the assessment of market distortion risks (Objective 1.2). Draft and formalise LME and LME Clear playbooks for each broad type of extreme event, recognising the need for flexibility and discretion given the wide variety of scenarios and inherent unknowns. Set out the expected roles of the LME and LME Clear under each scenario, alongside those of market participants and other stakeholders.

5.2 Engage with members to better understand how they manage client defaults on OTC and centrally cleared positions, and assess how the risks of such default scenarios can impact the LME. Collaboratively establish

guidelines for how to effectively manage such defaults including descriptions of ways to close large default portfolios on and off LME venues, identify members and clients with sufficient balance sheet (or natural interest) to take on the risks of a large portfolio should it need to be unwound quickly.

5.3 Rehearse the procedures developed with members, similar to the way in which member default fire drills are conducted today, to test if operational teams can respond swiftly should these events occur, and to increase understanding of the LME's likely actions in these scenarios. Apply lessons from fire drills to improve LME and LME Clear guidelines and provide feedback to participants.

Objective 6: Consider tightening rules to improve perceptions of member and LME Clear resilience

6.1 Enhance LME Clear's safeguards around member composition, which could include increasing minimum capital requirements, imposing stricter risk management requirements (including for monitoring clients). Provide transparency to the market that risk management standards are being continually validated.

6.2 Upgrade LME Clear member liquidity monitoring and explore introducing formal exposure limits on total member initial margin versus the member's capital and liquidity.

6.3 Improve LME Clear visibility into margin offsets provided to GCMs due to the DCVM and NOSA margin model, including the number of clients in each NOSA, and the extent of the difference between the 'gross' RVM and GOSA margin requirement versus the 'net' DCVM and NOSA margin requirement. Define and quantify any potential scenarios in which LME Clear should intervene to curb members from generating excessive leverage from DCVM and NOSA offsets due to level of risk posed to the market.

6.4 Assess further measures that could reduce risk and increase confidence in the stability of the clearing ecosystem, for instance by reviewing appropriateness of initial margin and concentration additional margin versus default fund size, considering sufficiency from defaulter-pay and total collateralisation perspectives.

Objective 7: Provide a clear vision for how the LME will respond to events and rebuild liquidity

7.1 Create a consolidated plan to deliver the recommendations of all reviews into the nickel market – including this independent review, internal reviews, and regulatory-led reviews. Provide the market with an overview of planned changes and the implementation timeline to build accountability and confidence.

7.2 Deliver on planned enhancements to the LMEselect electronic trading platform and communicate around further planned improvements.

7.3 Maintain a focus on refined nickel for the core futures contract. Continue to engage with participants across the nickel value chain and support the industry where possible in efforts to manage basis risks to other nickel products.

7.4 Over time, provide a clear vision of the future of market structure at the LME and LME Clear, including its venues, fee structure, clearing model and market access. Prioritise measures that will increase the depth and breadth of liquidity, diversity of interest, and transparency. Where possible – without significant loss of functionality to existing participants – commit to measures that would standardise the market structure with global peers to enable participation and consequent growth in liquidity. This may involve determining whether changes are necessary to the balance between the different objectives of the LME.

Conclusion

The independent review’s recommendations to the LME Group are intended to reduce the likelihood and impact of events similar to nickel in the future. Since the next event faced by LME Group and its members will inevitably differ, the recommended objectives not only address factors that contributed to the events in nickel, but seek to improve general awareness, accountability, and preparedness for all those dealing with the unexpected.

The most frequent cause of similar events historically is the build-up of large positions that trigger and end up on the wrong side of a major market move, thereby causing cascading client defaults. The recommended objectives, if implemented, would support the LME Group to manage market distortions of this nature. They would support the LME in identifying potential causes for extreme market moves. Further, they would help prevent the build-up of large, exposed positions by tightening enforcement processes. Should an extreme event still occur, volatility controls would help manage the price moves, and stronger risk management rules for members would limit damage from client defaults to the wider market.

Recommended objectives

- 1 Extend the mandate of LME’s risk and control functions to explicitly cover prevention of market distortions, and upgrade capabilities accordingly
- 2 Tighten LME rules and enforcement processes to prevent risks of market distortions
- 3 Monitor significant risks in the OTC market to manage risks of LME market distortions
- 4 Upgrade volatility controls to slow down extreme price moves
- 5 Build operational readiness across the market for managing extreme events
- 6 Consider tightening rules to improve perceptions of member and LME Clear resilience
- 7 Provide a clear vision for how the LME will respond to events and rebuild liquidity



Contributing factors

Addressed by

- | | |
|--|------------|
| Nickel is known to be volatile, prone to distortion, and exposed to geopolitical risks | 1 2
3 4 |
| The market believed there was pressure on large short positions | 2 |
| Position limits and accountability levels did not prevent the build-up of large, exposed positions | 2 |
| Fragmentation of positions across members and between on-exchange and OTC reduced visibility of risks | 3 |
| The LME’s price volatility controls did not control price volatility during the events | 4 |
| There was no well-rehearsed approach among members to close-out significant positions. | 5 |
| Eventually, market participants perceived that members may have been insufficiently robust to weather the events | 6 |
| Absence of a diverse range of participants willing to take opposite positions | 6 7 |
| Basis risks emerged from the use of LME nickel prices to hedge sales based on Class 2 prices | 2 3
7 |

Glossary of terms used

Terms used in this report

	Term used	Description in the context of this report
Institutions	The LME	Refers solely to the exchange, unless otherwise stated
	LME Clear	The wholly-owned clearing house for the London Metals Exchange, which provides clearing and settlement services for users of the LME
	LME Group	LME and LME Clear, referred to together
	Members	Institutions that provide services to end users for trading on the LME and clearing via LME Clear. Only members have direct access to LME markets.
	End users	Clients of LME members who access the LME markets indirectly through their LME members
	Financial participants	Members and end-users who include large dealer banks, prop traders, systematic funds, real money funds, and other investment managers
	Physical participants	Members and end-users who include producers (miners, refiners, recyclers), consumers, and merchant traders
Trading terms	On-exchange trade or ETD	Trades executed on LME Select or in the inter-office market that are centrally cleared via LME Clear
	Over the counter trade or OTC	Trades agreed bilaterally between two parties, without the supervision of an exchange and not centrally cleared
	LMEselect	The electronic member-to-member trading system of the LME, open 01:00–19:00 (UK time)
	3month contract	The most actively traded contract on the LME, requiring delivery in 3months time. Used throughout as the key indicator of the price of LME nickel
	Contract specifications	Rules for every metal traded on the LME that deliveries must conform to, including quality or purity, size, shape and approved manufacturers
	Lot	The size of a single trade in each LME contract, for LME nickel the lot size is 6 metric tonnes
	Cash price	The price on a given day of a metal for immediate (T+2) delivery
	Prompt date structure	The dates for delivery of a commodity that are available in the contracts on the exchange. The LME has daily prompt dates for the upcoming 3months, designed to create a daily cash price, mirror physical trading and allow users to accurately hedge their physical transactions down to the day
	Position limits	The maximum position that a market participant may take
	Price limits	The maximum price increase/decrease permitted from the previous day's settlement price
	Ask orders	The lowest proposed selling price quoted as the market selling price
	Bid orders	The highest proposed buying price quoted as the market buying price
	Bid-ask spreads	The difference between the bid and offer price
	Warrants	A document of possession for each lot of LME-approved metal held within an LME-approved facility. Warrants are used as the means of delivering metal under LME contracts
Basis risk	The potential risk that associated with imperfect hedging, in nickel this can arise by hedging class 2 production using LME nickel contracts	

Terms used in this report (continued)

	Term used	Description in the context of this report
Clearing terms	Client account	The account LME members hold with LME Clear that captures their clients' positions that were executed on-exchange or subsequently cleared
	House account	The account LME members hold with LME Clear that captures their own positions, including positions which offset client trades that are executed OTC
	Physical participant	Any client or member that can be categorised as either a consumer of nickel, producer of nickel, or a merchant trader
	Financial participant	Any client or member that can be categorised as either a large dealer bank or a fund
	Initial margin	The collateral that is posted when a trade is executed and is then adjusted, as necessary, through the duration of the trade. Initial margin must be paid to LME Clear and is calculated using Standard Portfolio Analysis of Risk
	DCVM	Discounted Contingent Variation Margin – the methodology used by LME Clear to determine margin required on positions, whereby losses are realised daily, but profits are only realised at the end of the contract (hence why LME physically settled futures are often referred to as 'forwards' rather than futures).
	RVM	Realised Variation Margin – a margin methodology wherein profits and losses are exchanged between the Clearing House and members daily
	NOSA	Net Omnibus Segregated Account – the account provided by the LME Clear to members to enable them to segregate client contracts from their house account.
Nickel market terms	Class 1 nickel	A nickel product containing at least 99.80% nickel, e.g. LME deliverable nickel products such as cathodes are class 1 nickel products
	Class 2 nickel	A nickel product containing less than 99.80% nickel, e.g. NPI, FeNi
	Refined nickel	Refined nickel refers to class 1 nickel products such as briquettes, cathodes and pellets
	NPI	Nickel Pig Iron – low purity nickel products produced from laterite nickel ore, usually containing 3–14% nickel
	FeNi	Ferronickel – low purity nickel products, usually containing 15–35% nickel