



ASIC
Australian Securities &
Investments Commission



ASIC's expectations for industry in responding to a market outage

Report 708 | November 2021

About this report

This report outlines the findings from our review of the market outage and other operational incidents that affected the ASX equity market in the week of 16 November 2020. It presents our observations on how ASX and key stakeholders were impacted by and responded to the issues, and sets expectations to support the resilience and robustness of the Australian equity market.

Contents

Executive summary	3
Observations	8
Expectations of market operators	13
Expectations of market participants	21
Expectations of large institutional investors	27
Appendix 1: Timeline of key events	28
Appendix 2: Accessible version of Figure 1	29
Key terms and related information	30

About ASIC regulatory documents

In administering legislation ASIC issues the following types of regulatory documents: consultation papers, regulatory guides, information sheets and reports.

Disclaimer

This report does not constitute legal advice. We encourage you to seek your own professional advice to find out how the Corporations Act and other applicable laws apply to you, as it is your responsibility to determine your obligations. Examples in this report are purely for illustration; they are not exhaustive and are not intended to impose or imply particular rules or requirements.

Executive summary

Technology is central to the fair, orderly and transparent operation of market infrastructure. As systems have become increasingly automated, complex and interconnected over time, the robustness and resilience of market technology and associated systems and processes is paramount.

Following the ASX equity market outage and other operational incidents that occurred during the week of 16 November 2020, ASIC:

- › in conjunction with the RBA, informed ASX of their expectation that an independent review be conducted in the first half of 2021. ASX appointed IBM Australia Limited (IBM) to undertake the independent expert review of the ASX Trade Refresh project (IBM review). ASIC published a [summary of the IBM review's conclusions](#) in August 2021
- › commenced an investigation into whether ASX had met its obligations under its Australian market licence
- › conducted a whole-of-market review of the outage and other operational incidents. This review included overall market observations, an account of the actions taken by and impacts on ASX Limited (ASX), Chi-X Australia Pty Ltd (Chi-X), market participants and investors. Our observations and expectations to enhance market resilience are presented in this report. The expectations build on recommendations from the last major ASX outage in [Report 509 Review of the ASX equity market outage on 19 September 2016](#) (REP 509).

Note: This report is separate from and broader in scope than the IBM review. We consider that where there is any overlap, the expectations set out in this report are broadly consistent with the recommendations of the IBM review.

Generally, ASX and other stakeholders have taken steps to implement the recommendations in REP 509—for example, by removing the dependencies of the ASX listing function on ASX Trade and consulting with industry on protocols for market outages. Our current review found that ASX broadly adhered to its procedures for incident management, including its communications protocol, during the 2020 market outage. However, only \$567 million in equities was traded on the market outage day, including just \$14 million after the ASX closed, compared with the average of \$10 billion per day in the prior week. Average bid-offer spreads on Chi-X after the ASX closed were around 20 times usual levels. The minimal level of liquidity and trading that continued elsewhere shows that further work is required by ASX and other stakeholders to enable sustained trading to continue on alternative trading venues in the event of a market outage.

This report highlights the serious deficiencies in ASX's and market participants' ability to limit the impact on overall liquidity highlighted by the outage despite some of these deficiencies having been raised by ASIC in REP 509. The expectations outlined in this report will ensure that more participants and investors are able and willing to trade on alternative venues in the event of a future market outage. We will be actively evaluating and monitoring the implementation of actions taken in response to this report to ensure that market operators and participants are taking appropriate steps to limit the impact on liquidity and investors in a future outage.

We expect market operators and participants to implement the measures set out in this report in order to maintain compliance with their obligations under the law. In addition, we have previously issued [Consultation Paper 314 Market integrity rules for technological and operational resilience](#) (CP 314). It is expected that these market integrity rules will be made in early 2022. A public feedback report detailing the key issues arising from the submissions on CP 314, and our response

to those issues, will be released at that time. These market integrity rules implement our expectations for market operators and market participants to ensure the resilience of critical business services, including change management, outsourcing, risk management, incident management, business continuity planning, governance and resourcing.

Operational incidents

There were several operational incidents that affected the ASX equity market during the week of 16 November 2020, which hindered its effective operation:

- › A weekend upgrade to the ASX Trade system introduced a software defect that affected tailor-made combination (TMC) orders, which led to the system broadcasting **erroneous market data** on Monday, 16 November 2021. This led to the **closure of the ASX market** at 10.24 am for the rest of the trading day, and there was very little trading on alternative trading venues.
- › **Centre Point trades** relied on incorrect 'national best bid and offer' (NBBO) prices on 16 and 17 November, and were disabled from 18 to 23 November. ASX's validation of NBBO trade reports between 18 and 20 November was also impaired.
- › **Mass order cancellation** functionality (generally used by market makers) degraded on 17 November, resulting in partial or complete failure of attempts to cancel orders in bulk using this functionality.
- › **TMC** orders were disabled from 17 November to prevent the market data errors from reoccurring, and were reintroduced with limited functionality on 21 December.
- › There was also a **delay to the equity market settlement process** on 17 November, which was unrelated to the ASX Trade outage. This issue was referred to in the RBA's [Assessment of ASX Clearing and Settlement Facilities—September 2021](#), and we do not consider this particular issue further in this report. However, this issue added to the market's concerns on operational resilience.

Findings and expectations from our review

Market operators are required to comply with their Australian market licence obligations and operate their market in a way that is fair, orderly and transparent. Market participants are required to comply with their Australian financial services licence obligations and provide their services to clients efficiently, honestly and fairly. Market operators and market participants also need to comply with *ASIC Market Integrity Rules (Securities Markets) 2017* (Securities Markets Rules).

ASIC's role is to supervise market operators and market participants, and take action if these obligations are not complied with. We consider that the expectations we have set out in this report are consistent with licensees' regulatory obligations and the regulatory framework. We expect that all market operators and participants will consider how to facilitate trading on alternative trading venues during a market outage. This is especially the case for client orders that have not been submitted to the market with an outage. However, consideration should also be given to whether and how to redeploy unexecuted orders that were submitted to the affected market before the outage.

The findings and expectations set out below are a summarised version of the detail provided in the latter sections of this report.

Our expectations of market operators

Findings	Expectations of market operators
<p>Technology status and market monitoring Participants notified ASX of market data errors and Centre Point trading issues, rather than these being proactively identified by ASX</p>	<p>E1: Develop automated systems and processes to proactively monitor for and identify market data issues and trading anomalies on its market in real time</p>
<p>Session states The ASX market remained in the Enquire session state after it decided not to re-open, the outage's underlying cause had been identified and there was a resolution pathway in place</p>	<p>E2: Refine procedures for session states during market outages, including clear thresholds for moving to a session state that accommodates participant interaction, and how and when this will be re-assessed on an outage day</p>
<p>Certainty about order status and trade positions Participants had difficulties reconciling their order status and trade positions. Although ASX provided assistance, many were not aware this was available, or did not receive it in a timely manner. Many firms were unwilling to continue trading without this certainty</p>	<p>E3: Refine policies and processes for providing participants with trade confirmations and order status, including playbooks and alternative systems and data formats. Prioritise ensuring that this information is promptly available, accessible and accurate</p>
<p>Frequency and content of communications ASX provided frequent updates on its system status webpage. While some stakeholders found this suitable, many indicated that these did not provide substantive information on the technical issues, likely severity or options available to them</p>	<p>E4: Review the communication protocol for market outages, including the scope of information and updates to be provided, and the delivery mechanism to other market operators, participants and other stakeholders</p>
<p>Intraday checkpoints and cut-off times ASX announced it would not re-open for the day at 2.58 pm. This timing contributed to uncertainty for participants earlier in the day</p>	<p>E5: Develop a protocol for intraday checkpoints during a market outage, including a final cut-off time after which the market would not be re-opened. This should also consider whether purging some orders (i.e. good-for-day), or the entire order book, is appropriate</p>
<p>Policies for disabling market components ASX did not disable Centre Point orders after identifying reference price errors, which could lead to trades that did not comply with Rule 6.1.1 of the Securities Markets Rules</p>	<p>E6: Document the circumstances under which particular order types or market components will be disabled, and the notice period before these changes are made</p>
<p>Software release testing framework ASX's testing program for the system upgrade did not involve market replay or participants simulating their usual order submission activities, which may have identified the sequence of events that led to the outage's root cause</p>	<p>E7: Develop a comprehensive test strategy for major trading system changes, including conducting end-to-end, regression and simulation testing</p>
<p>Business continuity planning and IT disaster recovery Business continuity plan testing conducted by market operators and participants has not included exchange outage scenarios, although the two most recent tests included some limited market shutdown and restart testing</p>	<p>E8: Facilitate testing of simulated market outage events during business continuity plan testing to enable participants to develop test cases to practice recovery strategies or switching to alternative arrangements for critical dependencies</p>

Our expectations of market participants

Findings	Expectations of market participants
<p>Arrangements to access alternative markets Many participants were unable or unwilling to facilitate client access to the alternative market during the market outage, due to limited arrangements to continue submitting orders</p>	<p>E9: Have arrangements in place to continue providing trading services and submitting new client orders to the alternative market. This may include through core electronic trading systems or third-party access arrangements</p>
<p>Dependencies on the ASX market Most participants' electronic trading systems were dependent on ASX being open and were therefore unable to systematically route orders to alternative trading venues without overnight reconfiguration</p>	<p>E10: Map and remove any dependencies that electronic trading systems have on any single market or order type. Configuration changes must be tested and documented so they can be made swiftly and safely to continue trading during a market outage</p>
<p>Best execution obligation and client instructions Some participants were hesitant to submit client orders to Chi-X for a range of reasons, including due to uncertainty around the application and interpretation of their best execution policies and arrangements during market outages and the impact on their own risk management</p>	<p>E11: Actively consider submitting new orders to alternative trading venues during a market outage. Review best execution policies and arrangements for trading during a market outage and facilitate trading on alternative trading venues, in accordance with client instructions</p>
<p>Client order priority Some participants were unsure whether Part 5.1 of the Securities Markets Rules prevents them from submitting newly received client orders to an alternative trading venue when existing orders are unable to be matched on or cancelled from another market due to an outage</p>	<p>E12: The client order priority obligations do not prevent participants from submitting new orders to an alternative trading venue, even if existing orders are unable to be matched or cancelled on another market due to an outage</p>
<p>Participant business continuity planning Many participants did not have robust business continuity plans to proactively respond to the ASX outage, including considering their trading arrangements during a market outage. Some participants were not fully aware of ASX's incident management protocol for market outages</p>	<p>E13: Comprehensively consider extreme but plausible scenarios, including market outages, in business continuity plans and best execution policies. Proactively identify vulnerabilities for critical business services, consider alternative arrangements and incorporate learnings from previous market incidents. Increase awareness of market operators' incident management protocols for market outages</p>
<p>Crossing system operators All crossing systems were closed or suspended at various points in time on the market outage day, but some participants were unsure whether a crossing system outage notification to ASIC was required</p>	<p>E14: Crossing system operators must decide whether their crossing system will continue operating, or be suspended or closed, and inform their clients. An outage notification must be submitted to ASIC if the crossing system is suspended or closed</p>
<p>Trade reporting The ASX market did not accept trade reports from participants during the market outage. It also used incorrect reference prices to validate NBBO trade reports over the next few days</p>	<p>E15: Review arrangements for trade reporting where a market is unavailable or having issues with trade validation, including how trade rejections will be managed</p>

Our expectations of large institutional investors

Findings	Expectations of large institutional investors
<p>Arrangements for market outages</p> <p>Many large institutional investors had wanted to continue trading during the market outage. There were mixed levels of awareness of their executing brokers' trading arrangements, as well as ASX's incident management protocols and index provider procedures, for market outages</p>	<p>E16: Review trading arrangements with executing brokers for market outages, including available trade types and dependencies on particular markets. Increase awareness of market operators' incident management protocols for market outages, and index providers' procedures where relevant</p>

Next steps

In conjunction with the publication of this report, we will be sending letters to a number of market operators and market participants requesting them to develop a response to our expectations. In 2022, we will continue to monitor market operators' and market participants' progress in taking steps to implement our expectations and enhance the resilience and robustness of Australia's equity market.

Some of our expectations will require ASX (and other market operators where appropriate) to consult with stakeholders and seek feedback from a broad range of market users before implementing changes. We expect these consultations to occur during 2022.

Industry is encouraged to consider if there are additional mechanisms (such as a re-opening auction to aggregate liquidity, incentives for liquidity providers or additional volatility controls) that may support liquidity and price formation on alternative trading venues during market outages, and engage with ASIC once proposals are well formed.

Observations

This section provides key observations from the ASX operational incidents that occurred during the week of 16 November 2020, including the responses of and impacts on ASX, Chi-X, participants and investors. An account of the market conditions on the days around the ASX equity market outage is also provided.

ASX equity market outage on 16 November 2020

Software defect and market data issues

The ASX Trade Refresh go-live occurred over the weekend of 14 and 15 November 2020. Soon after market open on Monday 16 November, a software defect introduced as part of this system upgrade resulted in incorrect order book data being broadcast by ASX systems. The software defect was traced back to TMC functionality, which enables a group of orders in multiple securities to be matched simultaneously and contingent on the other orders in the group also being matched. This resulted in market data for some securities to be either missing, delayed or duplicated.

Participants observed and reported anomalies in several securities to ASX Operations, including:

- › lack of opening auction trades in large capitalisation securities
- › overlapping bid and offer prices
- › trade prices that diverged from prevailing bids and offers, and
- › lack of trade confirmations for orders observed to match with other orders in the market.

Closure of the ASX market and communications

At 10.17 am, ASX announced on its systems status webpage that it was aware of market data issues affecting certain securities, and that this was being investigated as a priority.

ASX placed its equity market into the Enquire session state at 10.24 am while it continued to investigate the issues. The ASX market remained in the Enquire session state (which generally does not allow participants to cancel their orders) for the rest of the trading day. Nevertheless, five participants cancelled some of their orders by using ASX's cancel-on-disconnect functionality. In contrast, no participants used this functionality during the previous major ASX market outage on 19 September 2016, although it was available.

ASX continued to publish periodic updates on its system status webpage, generally every half hour. At 2.58 pm, it announced that the market would remain closed for the rest of the day. The normal end-of-day processes commenced at 6.50 pm, including purging good-for-day orders. ASX subsequently disabled TMC order creation to prevent the technical issue that caused the market data errors from reoccurring.

Impact on participants

We understand that there were three main impacts on participants from the market outage:

- › uncertainty around whether orders had been filled, either partially or fully, made it difficult to manage client expectations
- › lack of liquidity, concerns about price formation and difficulty trading on alternative trading venues led to heightened market risk on open positions, and
- › revenue was lost due to the significantly diminished level of trading activity.

Liquidity and trading activity on the day

Throughout 2020, market outages affected several major equity trading venues globally. Although most of these markets have alternative trading venues that remained operational, very limited liquidity and trading activity continued while the main trading venue was closed. We observed the same outcome during the ASX outage. While we had expected that market resilience enhancements made after the 2016 ASX outage would have supported more sustained trading activity continuing elsewhere after the ASX market was closed, this did not occur.

The Chi-X market remained open for on-market trading and trade reporting during its usual trading hours of 10.00 am to 4.13 pm. However, displayed liquidity was extremely thin and inconsistent throughout the day. Across S&P/ASX 200 securities on Chi-X after ASX closed:

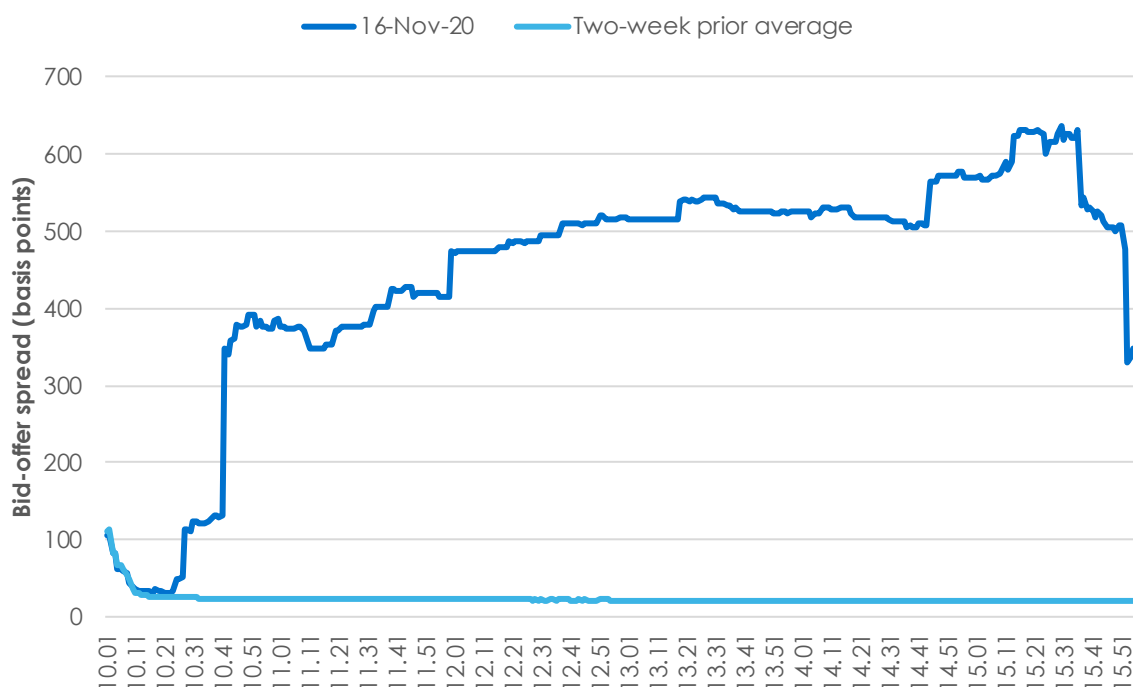
- › liquidity deteriorated in several stages when key liquidity providers cancelled their orders
- › bid-offer spreads (for securities that had bids and offers) were around 20 times usual levels, and

Note: Bid-offer spreads are only defined when there are both bids and offers in the market. Liquidity during the market outage was significantly worse than indicated by this metric alone, as many securities did not have bids and/or offers for most of the day.

- › market depth was around a third of usual levels.

Several market makers continued to quote bids and offers for most exchange traded products (ETPs) except Australian equity ETPs, where they were not confident in the prices of the underlying securities.

Figure 1: Average bid-offer spreads across S&P/ASX 200 securities on the Chi-X market



Note: See Table 1 for the data shown in this figure (accessible version).

After the ASX market was closed, \$14 million was traded during the rest of the day, including \$7.5 million matched on the Chi-X market and \$6.5 million from trade reporting.

A total of \$567 million in equities was traded on the day compared with the average of \$10 billion per day in the prior week. The ASX 24 futures market remained fully operational on 16 November 2020 and turnover was similar to the daily average across the prior week.

Equity market volatility implied by observed volatility in the SPI 200 index futures market was slightly lower than the prior week's average, and stakeholders noted that the market outage would have had a larger impact if it had occurred on a more volatile day or on an index rebalancing day.

There was \$32 million traded in ETPs on the day, which was around 7% of the prior week's daily average. There were very few trades in exchange traded options (ETOs), due to uncertainty about pricing data and general lack of liquidity in the underlying securities.

Withdrawal of key liquidity providers

Several firms who usually contribute to a significant proportion of order book liquidity on Chi-X scaled back their activities on 16 November 2020. One firm did not submit any orders on the day, while others cancelled their orders on Chi-X in the lead up to or soon after the ASX market was closed. These order cancellations resulted in the substantial liquidity deterioration and wider bid-offer spreads observed in Figure 1. Shortly after the ASX market was closed, the number of resting orders on Chi-X was around a tenth of the usual levels.

Some liquidity providers have explained that their initial response to any significant market operator technical issues is to cancel all their resting orders across all trading venues to minimise risk exposure. A few also operate cross-market liquidity provision strategies, which were unviable when the ASX market was closed. Some assessed whether to re-enter the Chi-X market after determining that the market data issues were limited to ASX but decided against this due to the very limited incoming order flow from other investors after ASX had closed.

ASX operational issues on 17 November 2020

ASX addressed the issues that led to the 16 November equity market outage by disabling TMC order creation. On 17 November, participants were able to conduct a normal start of day procedure, confirm the status of their orders from the previous day and access the correct order book state. However, several other operational issues affected the ASX equity market on 17 November. Some of these issues also continued on following days.

eBBO external reference price feed error

On the morning of 17 November, several participants reported to ASX Operations that they were seeing significantly fewer Centre Point trades than usual, and their Centre Point orders in some securities that should have matched based on market price movements were not being matched. ASX investigated this issue and identified an error with the 'external best bid and offer' (eBBO) data feed that is received from Chi-X and merged with ASX's own quotes to calculate the NBBO. This led to a failure to update eBBO prices soon after market open on the previous day.

Centre Point trade pricing

At 11.03 am, ASX announced via its system status website that it was aware of potential Centre Point data issues. A few participants ceased or significantly reduced sending Centre Point orders in response to this announcement. However, some recommenced following ASX's announcement at 11.17am that until further notice Centre Point trade prices would be based on the ASX best bid and offer and would not consider Chi-X's quotes. On the day, some participants advised that they may not be able to trade at all if Centre Point was closed, and that the time required to amend their algorithms to deal with the closure of Centre Point was not clear. After market close on 17 November, ASIC released [Media Release \(20-289MR\) Trading on ASX equities market today](#) to advise participants that by not considering Chi-X bids and offers, Centre Point trades may no longer satisfy the price improvement exception to pre-trade transparency in Rule 6.1.1 of the Securities Markets Rules. Participants were requested to take reasonable steps to remove their reliance on Centre Point swiftly and safely.

Validating price improvement trades

Participants experienced unexpected rejections of some NBBO trade reports to ASX because ASX was not using the correct NBBO to validate the prices of these trades. Several participants who usually report NBBO trades to ASX redirected these trade reports to Chi-X to avoid rejection of validly priced trades. ASX used the correct NBBO prices to validate NBBO trade reports from 23 November onwards, once the eBBO data feed issue was resolved.

Mass order cancellation

From around midday on 17 November, ASX's mass order cancellation functionality using MO4 messages began degrading and the severity of the issue increased over time. Both participants and ASX Trading Operations experienced partial or complete failure of mass order cancellation requests. This exposed market makers to significantly greater operational and market risk because they were unable to manage their large number of live orders as efficiently. ASX Trading Operations helped participants to manually cancel orders individually on a best-efforts basis. The incident was caused by an issue arising from specific Centre Point order submission strategies. ASX temporarily disabled these orders to prevent this issue from reoccurring.

Subsequent unavailability of market components

Centre Point orders

ASX disabled Centre Point orders and Centre Point Block orders between 18 November and 23 November 2020 while it resolved the issues affecting the mass order cancellation functionality and eBBO data feed. Around a third of the trading activity that usually happens on Centre Point shifted to Chi-X dark trades during this period.

Centre Point trades are matched at better prices than the displayed quotes on ASX and Chi-X, so their unavailability resulted in investors forgoing potential price improvement opportunities. In the week of 9 November 2020, Centre Point trades represented around 12% of on-market continuous session ASX trading and these trades received an average price improvement of around nine basis points over the displayed ASX quotes. Based on these figures, we estimate that investors would have benefited from around \$2 million in price improvement if Centre Point orders had been available from 18 to 23 November 2020.

Tailor-made combination orders

ASX disabled TMC order creation from 17 November 2020 to prevent the recurrence of the erroneous market data issues that led to the previous day's equity market outage. This included both TMC orders that can only match with other TMC orders, and TMC orders that can match with orders in the outright order book by using derived bait orders. Previously, around half of all ETO trades involved TMCs and 99% of this was TMC-to-TMC matching. A tiny proportion of equity market trades involve TMCs.

TMCs are commonly used to roll option positions, by selling an option that is nearing expiry and simultaneously buying an option with longer expiry in the same underlying asset, to maintain the investor's exposure. Without TMCs, participants and clients faced wider bid-offer spreads, risk of market movements between the time of the individual trades, additional workload and potential for operational errors in submitting multiple orders individually.

Creation of TMC orders for TMC-to-TMC matching only was restored on 21 December 2020. On 4 May 2021, ASX announced that it had assessed the risks and benefits of TMC-to-outright matching with derived orders and had decided not to re-enable this functionality.

Expectations of market operators

This section outlines our expectations of market operators in enhancing technology resilience and responding to operational incidents, including market outages. We assess whether ASX followed its procedures and arrangements for incident management, including communication with stakeholders, during the market outage. During a market outage, we expect market operators to prioritise providing participants with the information and certainty they require to continue trading on alternative trading venues. This is part of their obligation to operate a 'fair, orderly and transparent' market. Our expectations on technology resilience also relate to a market operator's obligation to have sufficient resources (financial, technological and human) to operate the market.

ASX has implemented most of the recommendations made in [REP 509](#) in 2016, and many of these enhanced its incident management during the November 2020 market outage. The following is a non-exhaustive list of initiatives that ASX has implemented based on ASIC's previous recommendations:

- › removing dependencies between ASX's listing function and its trading platform, including developing an alternative market announcement platform to disseminate individual security trading statuses and market announcements independently of ASX Trade
- › providing frequent system status updates via a central webpage
- › having specified notification periods, including for delays to market open and before an intraday market re-opening
- › developing pre-established procedures for closing and settlement prices when the closing auction is disrupted
- › halting the entire equity market when a subset of securities experiences technical issues
- › strengthening its business continuity management and IT disaster recovery arrangements, including engaging independent experts to improve its procedures
- › outlining the conditions for moving from the Enquire session state to the Adjust session state (which allows participants to cancel their orders) during an outage
- › segregating duties for key operational tasks
- › collating documentation on the architecture of key systems into a central repository
- › implementing and enhancing monitoring tools and alerts across ASX Trade, and
- › consulting on potentially removing the opening auction rotation (whereby securities are placed into five groups and each group's market open is staggered a few minutes apart), although mixed stakeholder feedback was received and this item remains in progress.

Notwithstanding the progress made, we consider that there are areas where ASX's technology resilience and incident management arrangements for market outages could be enhanced. Our current expectations include:

- › developing market monitoring arrangements for upgraded trading systems, including to detect market data errors and trading anomalies
- › providing further clarity on thresholds to move the market from Enquire to a more accommodative session state
- › exploring alternative session states that could allow participants to manage their orders while mitigating risks to the trading system and market data from order amendments
- › prioritising arrangements to provide participants with certainty on their order status and trade positions
- › increasing the content of communications with participants and other market operators
- › establishing intraday checkpoints and a final re-opening cut-off time, and
- › developing comprehensive test strategies for new software releases that cover a wide range of system functionality, performance and data aspects.

Some of these expectations reflect and expand on our recommendations in [REP 509](#), including around session states, communications and technology resilience. This reflects the fact that some of our previous recommendations were implemented only in part, while other recommendations were not adopted and should now be reconsidered. The expanded, or additional, expectations aim to provide increased clarity and confidence for participants and other market users. Most of the expectations in this section are intended for all market operators, although several are specifically identified for ASX, given its role as the listing market and main trading venue.

Equity market closure on 16 November 2020

Market monitoring and initial response to market data errors

Incorrect market data issues were raised by participants and Chi-X soon after market open on 16 November. ASX started examining these market data issues from around 10.05 am. ASX did not have automated systems and processes to proactively monitor for erroneous market data generated by its trading system, such as overlapping bids and offers during the Open session state when bids and offers are matched on a continuous basis. At 10.17 am, it published the first system status webpage update for the incident to advise participants that it was aware of market data issues in partition 3 securities and was investigating.

Additionally, there were significantly fewer Centre Point trades and ASX rejected a larger proportion of NBBO trade reports than usual in some securities on 16 November due to a combination of ASX's market data errors and errors with its eBBO data feed. The lack of trades was also identified by participants and raised with ASX on the morning of 17 November.

In REP 509, we recommended that ASX implement a more comprehensive and robust monitoring regime, and review its automated data integrity checking processes to ensure that reference values and states of critical data elements are in a consistent state, as a routine check to detect abnormal systems behaviours. ASX has made progress in this area, although we expect ASX to continue to enhance its monitoring capability of market data issues and trading anomalies within its systems.

Expectation E1

- › Market operators should develop automated systems and processes to proactively monitor for market data issues within their trading systems and identify trading anomalies in real time.

Enquire session state

The ASX equity market was closed at 10.24 am by placing it in the Enquire session state. This session state locks the order book so orders cannot be entered, amended or cancelled. It is used while an investigation into the causes and implications of an issue is undertaken. In REP 509, we recommended that the Enquire session state should only be used for as long as is necessary to protect the integrity of the order book while ASX investigates and diagnoses any technical or operational issues. After this has occurred, it is our view that ASX should consider transitioning to a more accommodative session state, such as Adjust, to allow participants to cancel their orders and submit them to an alternative trading venue in our multi-market equities trading environment.

A large number of unfilled or partially filled resting orders in the ASX market could not be cancelled by participants. This included around 245,000 good-till-cancelled and good-till-date orders submitted on previous trading days, around 75,000 good-for-day orders and around 36,000 good-till-cancelled and good-till-date orders submitted earlier in the day. There have been suggestions overseas for market operators to purge good-for-day orders during a market outage—given the large number of these orders submitted each day, market operators should consult with participants on the suitability of this option.

At 2.58 pm, ASX announced that it would not reopen for the day, the outage's underlying cause had been identified, and there was a resolution path in place to allow trading to commence the next day at 10.00 am. No session state changes were made until the usual move to Purge Orders at 6.50 pm when good-for-day orders were purged. ASX has stated that it evaluated whether to move from Enquire to Adjust during the incident but did not make this change because it could have affected message integrity.

Following the 2016 market outage, ASX consulted on and established procedures to move from Enquire to Adjust where this would not be detrimental to the resolution of the technical problem or delay the reopening of the ASX market. A more detailed condition stated that moving to Adjust would not compromise the trading system. On 16 November 2020, ASX kept the market in the Enquire session state because it had concerns about message integrity. However, while message integrity was not one of the conditions that ASX had stated it would keep the market in Enquire for, it considered message integrity issues could have compromised the trading system.

Most participants we spoke with understood why the ASX market was initially placed into the Enquire session state while the issues were being diagnosed but would have preferred the market to subsequently move to Adjust, especially after ASX announced it would not re-open for the day. This would have enhanced their order management arrangements, including cancelling unfilled orders from ASX before re-submission to an alternative trading venue, as required by their internal risk controls.

Participants we spoke with were generally unaware of the risk of market data errors being compounded if the market had been moved to Adjust, including not receiving confirmation messages on some order cancellations or some order cancellations failing. However, most considered that this risk was tolerable, compared with not being able to cancel any of their orders on the ASX market while it was in Enquire, unless they used cancel-on-disconnect.

Expectation E2

- › Market operators need to refine their procedures for session states during market outages. This includes clear thresholds for moving to a session state that accommodates participant interaction, check points at which this will be re-assessed throughout the day, staff responsible for providing advice and decision making, and consideration of participants' order management requirements to continue trading on alternative trading venues.
- › ASX should explore alternatives to the Enquire session state for mitigating risks to its trading system and market data from order amendments during market outages, and assess options that allow participants to manage their orders. This may involve purging some (i.e. good-for-day) or all orders submitted on the day after a specified checkpoint time, or developing additional session states, and will require further consultation with participants.

Certainty about order status and trade positions

Market data errors in partition 3 resulted in participants not receiving confirmations for some trades, so they did not have an accurate view of their risk positions for executed transactions and open orders. This contributed to their reluctance to continue trading on the day. We understand that ASX had processes in place to provide participants with accurate information on their matched trades from the morning, and this was available to participants from around an hour after the outage commenced. However, many participants were either unable to use this alternative process or experienced significant delays and could not reconcile their positions until the evening. Participants were unable to confirm the status of their orders in partition 3 instruments until the usual start-of-day processes at 2.25 am on 17 November. We understand that alternative processes for providing participants with accurate information on open orders would be highly complex and may not have addressed this issue if the underlying order data was corrupt.

Participants also advised that the format in which they receive trade positions via alternative arrangements is important due to the interconnected nature of their algorithms and existing communication methods with trading venues.

Expectation E3

- › Market operators need to refine their policies and processes for providing participants with trade confirmations and order status. This includes the development of playbooks with a hierarchy of alternative systems and data formats for providing information to participants so they can continue trading on alternative trading venues in an informed manner. Further consultation with participants on technical requirements is likely to be required.
- › Market operators must inform all participants of alternative arrangements in place to provide trade confirmations during operational incidents where they are not reliably available via the usual channels. Market operators need to ensure that this information is promptly available, accessible and accurate.

Frequency and content of communications

Many participants indicated the half-hourly updates provided on [ASX's system status webpage](#) were helpful. However, participants also raised several concerns, including that:

- › there was substantial confusion and uncertainty about the nature and scale of the issues
- › the updates were very general and did not provide any substantive information, and
- › it was effectively in a holding pattern, with no indication as to how long the market outage would likely take to be resolved.

Some participants had phone calls with ASX staff to attempt to gather further information on the market outage, including specific issues that affected their firms.

Some stakeholders indicated that an open conference line that participants and other stakeholders can dial into during a market outage is an alternative mechanism to provide key updates and information efficiently and equally to market users. However, this option may also create further complexities, such as maintaining appropriate focus, resourcing and monitoring of the issues that are being assessed. We consider there is merit in further exploring the costs, benefits and feasibility of this option.

In 2016, Chi-X suggested that a three-way communications channel could be opened between ASX, Chi-X and ASIC in any future market outages. This suggestion was not adopted by ASX and did not occur on 16 November 2020, which meant that Chi-X had to rely on the public information being provided by ASX to understand the nature of the market outage.

Expectation E4

- › Market operators need to review their communication protocol for market outages and consult with participants on the types of additional updates and standardised information that could help with providing greater certainty, including nature of issues, order status, order management and the process for reconciling trade positions.
- › Market operators must develop and agree on communications protocols for incidents or major events (including outages) that may affect other market operators that rely on and interact with common market infrastructure. Depending on the nature of a market outage, coordination between market operators may be critical for re-establishing an orderly market.

Intraday checkpoints and cut-off time for re-opening

During the 2016 ASX equity market outage, the market's opening was delayed and it was closed at 2.05 pm after issues re-emerged. Given the market re-opened intraday after the initial outage and the subsequent outage was fairly late in the afternoon, [REP 509](#) did not review whether market operators need to set a cut-off time for re-opening the market on an outage day.

We understand that ASX's incident management procedures on 16 November 2020 included several key checkpoints but did not include a pre-determined cut-off time for re-opening the market. This added to the uncertainty faced by participants and their clients as they were unsure whether to continue waiting for the ASX market to be restored or to migrate their trading activity to alternative trading venues.

Most participants supported a cut-off time of two hours after the outage occurred, and no later than 2.00 pm. They considered that this would balance providing a sufficiently long period after the cut-off to allow meaningful trading volumes on alternative trading venues, while also providing the market operator with a reasonable length of time to diagnose and resolve issues that could be fixed intraday. Most participants were strongly opposed to delaying the usual market closing time to allow trading to recommence on an outage day because it would disrupt their end-of-day processes. Some stakeholders suggested that different cut-off times ought to apply depending on the cause of the outage, such as hardware or software issues.

Expectation E5

- › Market operators must develop a formal protocol with intraday checkpoints during an outage day and a final cut-off time after which the market would not be re-opened. This includes threshold issues that would enable the market to be re-opened, minimum required trading session length to support orderly trading, and notification time for participants to prepare for resumption of trading.
- › Market operators should consider the feasibility of alternative approaches that may assist with restoring trading more quickly, such as an intraday reboot of key trading systems or purging some or all existing orders. This may require further consultation with participants to understand the risks and benefits of this approach.

Closing and settlement prices

The closing prices and settlement prices established on 16 November 2020 used the last traded price on the ASX market prior to the outage. This was consistent with ASX's procedures published following its 2016 equity market outage. Although these prices were potentially stale, almost all trades on Chi-X later in the day were at very similar prices to the last traded price on ASX. We are aware of suggestions overseas for alternative markets to operate the closing auction, if the main market is experiencing an outage, to achieve a tradeable closing price. We received mixed responses from our stakeholders for this option. Many firms cautioned that a backup auction would require significant costs and complexity, and that only a few firms would use it during an outage unless it is used frequently. At this stage, we are not supportive of establishing competing closing auctions on normal trading days because they would fragment liquidity and impede price formation during this critical phase of trading.

Note: See ASX, [What the ASX market price represents and how ASX Clear calculates settlement prices](#) (PDF 454 KB).

Disabling Centre Point orders

Decision and timing for disabling Centre Point orders

The threshold issue that led to ASX disabling Centre Point orders on 18 November 2020 was the risk of mass order cancellation degradation reoccurring. This issue was identified on the morning of 18 November 2020 prior to the opening of the ASX equities market.

At 8.12 am, ASX announced that it would suspend Centre Point orders and Centre Point Block orders until further notice, and these orders would be rejected. This was less than two hours before the market's opening time. A further update at 8.41 am advised that participants could test this in the test environment. Many participants would have preferred a longer notice period to alter their systems and to ensure they would continue to operate effectively. Some participants also had to contact clients—who had requested trading using a particular strategy that relied on Centre Point orders—to seek updated instructions.

We consider that the eBBO data feed issue should have led ASX to disable Centre Point orders after market close on 17 November to avoid potential breaches of Rule 6.1.1 of the Securities Markets Rules. Had this decision been made, it should have been communicated to the market on the same day to provide participants with ample time to make overnight changes to their systems in preparation for market open the next day.

Monitoring order types that cannot be disabled

ASX could not disable the dual posting functionality of Centre Point Sweep orders. It established real-time monitoring to identify and cancel any such orders since they had the potential to cause the recurrence of the mass order cancellation issues. Any trades matched also risked not providing the required price improvement under Rule 6.1.1 of the Securities Markets Rules. ASX asked participants to cease submitting these orders but a few participants continued. One Centre Point trade occurred on 23 November because the resting order could not be cancelled before it was matched.

Expectation E6

- › Market operators need to document the circumstances under which particular order types or market components will be disabled, as well as the notice period before these changes are made. This includes procedures for changes before market open as well as intraday.
- › Market operators should develop robust arrangements for order monitoring and management, where order types that cannot be disabled create the risk of significant operational issues or market integrity concerns, to complement our expectations for market monitoring outlined in Expectation E1.

Technology and resilience

Software release testing framework

As noted in [Media Release \(21-220MR\) Update on the independent expert review of November's ASX Trade outage \(23 August 2021\)](#), one of the findings from the IBM review was that it was not reasonable to expect the test plan used for the ASX Trade Refresh project would meet ASX's near zero appetite for service disruption. ASX has agreed to address the recommendations from the review, including those related to testing.

ASX's testing program did not involve testing using historical order submission patterns from market replay, or with participants simulating their usual order submission activities. This may have identified the sequence of events that led to the root cause of the market outage.

The derivatives market of Hong Kong Exchanges and Clearing (HKEX) experienced a similar technical incident with MO 37 two-sided price quotes and combination orders leading to erroneous market data and the market needing to be closed. HKEX conducted testing with participants in a practice session when verifying the fix for this issue.

The ASX market outages in 2016 and 2020 have both demonstrated that in a multi-market equity trading environment there are dependencies between trading venues that must be clearly understood and effectively managed to support overall market resilience (e.g. eBBO data feed issues affected NBBO calculations).

Based on our understanding of the interactions between market operators before the ASX Trade Refresh project went live, there are likely to be opportunities for improvement in the nature and quality of these interactions on future projects to avoid similar issues.

Expectation E7

- › Market operators need to have a comprehensive test strategy that includes a wide coverage of the system (functional, non-functional and operational aspects) and data.
- › Regression testing should be conducted across the entire suite of test scenarios to demonstrate that any changes will not introduce defects.
- › Market operators should conduct simulation testing with participants and other market operators to simulate scenarios with their usual order book activities ahead of major equity market system changes.

- › Given the interconnectedness of market infrastructure, market operators must work closely and constructively with one another whenever a new trading system or other major upgrade is implemented and make every effort to ensure that all relevant connections operate as expected on an end-to-end basis.

Business continuity planning and IT disaster recovery

Several participants have recommended that exchange outage scenarios be included as part of participants' and market operators' business continuity plan testing. Participants would be able to test the ability of their systems to switch from each market operator to the other.

The most recent post-outage business continuity plan testing had one of the highest participant participation rates in recent times. The last two business continuity planning tests included some limited market shutdown and restart testing.

Expectation E8

- › Market operators should facilitate testing of simulated market outage events during their business continuity plan testing that enable participants to develop test cases to participate in these scenarios.
- › Recovery strategies or alternative arrangements for identified critical dependencies should be exercised (or, where appropriate, tested) as part of or in addition to standard business continuity plan exercises and tests.

Expectations of market participants

ASIC's expectations of market participants during a market outage

In the event of a market outage, our immediate priority is the integrity and resilience of the wider equity market to support the continuation of trading in a safe and reliable environment. We expect participants to have the operational ability to continue to offer their usual suite of trading services to clients during a market outage, and support equity market resilience. This includes removing dependencies on a particular market being available and having and exercising the ability to route new orders to an alternative trading venue.

We recognise the challenges faced by participants during a market outage. However, we expect participants to actively manage their operational resilience and response to market disruptions, including outages. Participants must clearly and transparently communicate to clients what is happening, which order types and trading venues are available, how their new and existing orders will be treated, and any impact on client instructions and achieving best execution. We expect participants to update best execution policies and other documentation to reflect changes made by participants in accordance with ASIC's expectations, and to communicate these changes to clients.

Considerable progress has been made to implement the recommendations for participants in [REP 509](#), including communication channels, involvement in market operators' business continuity testing, updates to best execution policies and arrangements for undertaking crossings. However, we found that several issues persisted at the time of the market outage, notably that participants' algorithms and smart order routers were not configured or adjusted to adequately respond to the market outage, and that participants did not have robust business continuity arrangements in place. This lack of preparedness from industry indicates that further work needs to be undertaken by participants. We have written to the CEOs of several market participants requesting they consider these expectations and report to ASIC on how their firm has implemented or plans to implement them. We will be engaging further with market participants in 2022 to review how industry has adopted our expectations.

Arrangements to access alternative markets

We found that several participants were unable or unwilling to facilitate client access to the alternative market during the market outage. Many clients reported they had wanted to trade on the alternative market. However, their brokers were unable to provide continuation of service due to electronic trading system dependencies on the affected market and limited arrangements to submit orders to the alternative market.

Participants must have arrangements to provide clients with access to the alternative market during a market outage. This may include access to the alternative market through core electronic trading systems or through third-party access arrangements. We expect participants to have the operational ability to accept and submit new orders received during an outage, allowing clients to continue trading with minimal disruption.

Participants should have alternative arrangements to achieve the best outcomes for their clients in situations where specific market components are either operating incorrectly or are unavailable. For example, participants may consider conducting trades with price improvement on other markets or through trade reporting, when these are not available on a particular market. Under normal market conditions, we expect participants to consider the potential for price improvement opportunities on Centre Point, to meet their best execution obligations when routing client orders to the ASX market.

Expectation E9

- › Participants need to have arrangements in place to allow them to submit client orders to the available market.
- › Participants without access to an alternative market need to continue to assess the costs and benefits associated with accessing (directly or indirectly) that market, including the operational resilience benefits of continued market access in the event of an outage.

Removing system dependencies on a single market

During the market outage, we observed that most participants' electronic trading systems (including algorithms and smart order routers) relied on an open ASX market to operate. With the ASX market unavailable, this reliance meant that some participants could only continue trading in a very limited capacity through designated trading representatives and trade reporting until system changes were made. A few participants were able to quickly reconfigure systems to continue trading on alternative trading venues, but others were unable to make these intraday changes or were unwilling to because they had not been rigorously tested. In some cases, these dependencies also extended to trading systems provided by participants to their clients.

We expect participants to remove dependencies on the availability of a particular market to enable continued facilitation of trading in the event of a market outage. We expect participants to proactively map out different market outage scenarios to establish predetermined processes and system reconfigurations that would be appropriate to address the scenarios. This may include establishing processes to continue to facilitate trading if a market component, such as ASX Centre Point, is unavailable. Participants may also consider a range of varying liquidity conditions on the trading venues that remain available in order to prepare processes and systems accordingly. Participants need to have robust and adequately tested solutions to confidently respond to a range of operational disruptions and minimise ad-hoc system changes required.

Participants should consider the appropriateness of risk management measures that rely on the prices on a particular market in situations where there is sufficient liquidity and price formation on other markets. Participants should also consider whether their clients' market data access arrangements may inhibit their ability to continue trading in an orderly and informed manner if a particular market is unavailable, and the viability of alternative arrangements.

Participants should proactively discuss appropriate options with their vendors to prepare timely and robust changes in the event of a market outage. Additionally, alternative arrangements should be in place and tested to account for scenarios where timely and/or orderly recovery of the participant's primary trading systems is not possible.

Expectation E10

- › Participants should map and remove any dependencies of their electronic trading systems on any single market, order book or order types. Removal of these dependencies will prepare and enable participants and their clients to continue their usual trading activities in the event of a market outage.
- › Configuration changes should be made swiftly and safely through the participant's usual system change governance process, including testing and documenting the changes. To the extent that intraday configuration changes are necessary, we expect care to be taken

to avoid affecting the fair and orderly operation of the market, and the changes must be documented and tested.

- › Participants are responsible for managing their orders at all times and must not be reliant on a market operator to reject certain orders that may create market integrity risks.

Best execution obligation and client instructions

Rule 3.8.1 of the Securities Markets Rules requires participants to take reasonable steps to obtain the best outcome for a client when handling and executing an order for that client, subject to any specific client instructions under Part 3.3 of the Securities Markets Rules. Some participants were hesitant to submit client orders to Chi-X for a range of reasons, including uncertainty around the application and interpretation of their best execution policies and arrangements during market outages and the impact on their own risk management. Participants need to assess the trading venues and types of trading that remain available during a market outage, and expected implications for trading outcomes under the prevailing market conditions. We expect participants to make trading available to clients, rather than ceasing to trade during a market outage.

We expect new orders received during a market outage to be submitted to an alternative trading venue, with appropriate risk controls implemented to avoid trades that are not in the best interest of a client, such as those at unfavourable prices if liquidity is thin.

Despite limitations imposed by the market's session state, participants must consider risks and responsibilities to clients in assessing how to manage orders already resting on the market with an outage. Participants should consider moving resting orders to the available market where operationally possible and where this does not risk harming market integrity. We do not expect participants to move significant volumes of resting client orders to an alternative market during a market outage if this presents significant operational risk.

We acknowledge the difficulties relating to different order types between markets (in particular, good-till-cancelled orders). However, we expect participants to provide clarity to clients intending to trade on alternative trading venues during a market outage by explaining how this may affect them and how these orders will be treated. If a participant intends to manage orders flexibly (e.g. where a client does not normally trade on alternative trading venues), treatment of orders must be proactively and accurately reflected in the participant's best execution policy and other available documentation.

Expectation E11

- › A participant's best execution obligation does not fall away during a market outage. Participants must actively consider submitting new orders during a market outage to alternative trading venues in accordance with clients' instructions.
- › Participants must review their best execution policies and arrangements for trading during a market outage and ensure that they are operationally prepared to trade on an alternative trading venue if requested by clients.
- › Participants with access to multiple markets are expected to provide clients with the choice and ability to trade by submitting new orders to alternative trading venues.

Client order priority

Participants asked ASIC whether the client order priority obligation prevents them from submitting newly received orders to an alternative trading venue while existing orders are unable to be matched on or cancelled from another market during a market outage.

We consider that the client order priority obligations in Part 5.1 of the Securities Markets Rules do not prevent participants from submitting new orders to an alternative trading venue. We expect participants to submit new orders to an alternative trading venue during a market outage. This applies even when existing orders are unable to be matched or cancelled on a market due to an outage. The new orders must be submitted in accordance with the obligations in Part 5.1 of the Securities Markets Rules.

Expectation E12

- › During an outage on a particular market, participants should submit new client orders to an alternative trading venue where available. The client order priority obligations do not prevent this, even if there are existing orders unable to be matched or cancelled on another market due to an outage.

Participant business continuity planning

Most participants did not appear to have robust business continuity plans to proactively respond to the market outage, with many participants acknowledging they had not envisaged the impact of the outage and subsequent issues on their ability to continue trading. Despite recommending in [REP 509](#) that participants review their preparedness for market outages, we observed that many participants were not prepared for the impact of the outage and had not actively considered their trading arrangements should a particular market become unavailable.

In business continuity plans, participants are expected to consider a range of scenarios that may affect their ability to facilitate trading for clients. Participants need to prepare alternative arrangements to continue to provide services in response to these scenarios. Business continuity plans (including disaster recovery and crisis management plans) must be continually developed to incorporate responses to future market disruptions and learnings from previous market incidents.

We expect participants to identify 'single points of failure' (e.g. resources/suppliers/platforms) for critical business services, and to incorporate fully tested recovery or alternative arrangements into business continuity plans.

Participants should evaluate the benefits and risks of market operator functionalities that may help with their incident response arrangements, such as cancel-on-disconnect, when considering a range of market access and outage scenarios. Cancel-on-disconnect allows participants to cancel orders while the ASX market is in the Enquire session state during an outage. It requires pre-configuration, with the options of cancelling all orders, good-for-day orders, or no orders, when there is a disconnection event. However, it also presents risks, including unintentionally purging orders due to disconnections initiated by network issues, functioning ineffectively if market components are experiencing significant technical issues, and being potentially disruptive for some participants' trading systems. Prior to implementation, participants must be satisfied that this functionality provides a robust mechanism to manage different scenarios as part of business continuity planning. Participants' business continuity plans also need to consider how they would respond to a market operator purging all orders, either intentionally or unintentionally, during a market outage.

Some participants we met with were not aware of key parts of ASX's incident management procedures for market outages, including the minimum notification times that would be provided before an intraday re-opening following a market outage. This contributed to their uncertainty and reluctance to continue trading on alternative trading venues during the outage. Participants should ensure that relevant staff are subscribed to ASX's system status update messages.

Expectation E13

- › Participants are expected to comprehensively consider extreme but plausible scenarios in their business continuity plans and best execution policies, including a range of market access and market outage scenarios.
- › Participants' business continuity plans need to incorporate market operators' incident management procedures for market outages.
- › In addition to any tests occurring as a coordinated effort between market operators and participants, participants should (as a matter of best practice) consider how thoroughly they have accounted for critical dependencies, the recovery strategies in the case of disruptions to these dependencies and, where recovery is not possible, alternative arrangements (e.g. secondary suppliers/platforms/vendors).

Crossing system operators

Some participants were unsure whether a crossing system outage notification needed to be submitted to ASIC under Rule 5A.2.3 of the Securities Markets Rules as they considered the underlying cause to be the market outage, which is an external factor.

Crossing system operators suspended (ceased matching but retained existing orders) or closed (purged all orders) their crossing system at various points in time during the market outage. However, not all submitted a crossing system outage notification to ASIC. It is up to the crossing system operator to determine whether they close, suspend or continue to operate their crossing system during a market outage, which may be informed by client demand and assessment of market conditions. This decision and the status of the crossing system must be promptly communicated to clients. If a crossing system operator chooses to close or suspend a crossing system during a market outage, the operator must submit a crossing system outage notification to ASIC under Rule 5A.2.3 of the Securities Markets Rules.

Expectation E14

- › Crossing system operators must be transparent with their clients about any changes to the operational status of their crossing system during a market outage.
- › If a crossing system operator decides to close or suspend a crossing system, a crossing system outage notification must be submitted to ASIC under Rule 5A.2.3 of the Securities Markets Rules.

Trade reporting (including from crossing systems) and trades with price improvement

The ASX market does not accept trade reports when it is in the Enquire session state. Participants should consider their arrangements for reporting trades that are matched away from an order book and rely on an exception to pre-trade transparency under Rule 6.1.1 of the Securities

Markets Rules to another market where a market is not accepting trade reports. This includes block trades, portfolio trades, trades with price improvement and trades outside of market hours.

ASX's market data errors and market outage on 16 November 2020 led to confusion for some participants about the requirements for trades with price improvement. We remind participants of the following guidance:

- › [Regulatory Guide 265](#) *Guidance on ASIC market integrity rules for participants of securities markets* advises that NBBO trades may be matched at the locked price in a locked market (equal best bid and offer prices) and should not be matched in a crossed market (overlapping best bid and offer prices) but may be matched at the midpoint of the crossed quotes if trading is imperative. This includes where market data errors lead to the appearance of locked or crossed markets in some securities.
- › In [REP 509](#), we advised that only the quotes on available markets should be considered for constructing the NBBO prices during a market outage.

Between 16 and 20 November 2020, ASX's market data errors and eBBO issues led to it using incorrect reference prices to validate NBBO trades. Participants should have their own arrangements for ensuring that trades with price improvement are executed at valid prices. They should also have arrangements for managing trade reports that are rejected. This may involve reporting these trades to an alternative market that is using the correct reference prices during this period or ceasing to execute trades with price improvement.

Only a few participants ceased or significantly reduced their submission of Centre Point orders once it became apparent that ASX was using its own prices, rather than the NBBO prices that incorporate Chi-X quotes, as the reference prices for Centre Point trades on 17 November 2020. This could have led to some participants' trades not meeting the pre-trade transparency requirements or available exceptions to pre-trade transparency under Rule 6.1.1 of the Securities Markets Rules.

Expectation E15

- › Participants should review their arrangements for trade reporting where a market is unavailable.
- › Participants should review their arrangements for pricing, executing and reporting trades with price improvement (including from their crossing systems) where there are issues with a market operator's validation of these trades. This includes how they will manage rejections from a market operator.
- › Participants are required to ensure that their trades with price improvement matched on exchange markets meet the price improvement requirements in Rule 6.2.3 of the Securities Markets Rules.

Expectations of large institutional investors

Arrangements for market outages

Several large institutional investors that we engaged with had wanted to continue trading significant volumes after the ASX market was closed but almost all their brokers were unable to facilitate this by submitting their orders to the Chi-X market. A few of these firms have proactively contacted their brokers to understand their dependencies on either market operator being open, and whether steps are being taken to remove these dependencies. A further dependency was that some trading systems used by these firms and provided by their executing brokers also had dependencies on the ASX market being open.

Several institutional investors noted that not being able to trade the underlying instruments held by their funds would have caused significant issues if the outage had occurred on a day that required significant trading activities, such as an index rebalancing day or a day with large inflows or outflows from investors. Issuers of ETPs were able to facilitate creation and redemption requests for Australian equity funds where they were done in kind, with fund units being exchanged for a basket of underlying securities.

Not all firms we met with were aware of ASX's incident management arrangement for handling market outages, including communication channels, notification periods prior to the market re-opening and how closing prices would be determined if the closing auction was disrupted. This contributed to their uncertainty and reluctance to continue trading. A few firms that use indices from major index providers were not aware of their index calculation frameworks and methodologies for closing prices during an outage of the main trading venue. These procedures generally set the closing price as the last traded price on the main trading venue where available, even if there were more recent trades on other trading venues.

Expectation E16

- › Large institutional investors should review trading arrangements with executing brokers for market outages, including the types of trading that remain available, any dependencies on particular markets and alternative arrangements where trading is critical.
- › Large institutional investors should review market operators' incident management protocols for market outages.
- › Firms that rely on indices should review index providers' procedures for market outages.

Appendix 1: Timeline of key events

Date	Time	Key observations, events and decisions
16 Nov	10.01 am	An existing quote in the order book of a TMC was updated by an MO 37 quote, leading to the creation of an erroneous bait order
	10.05 am	ASX Operations started receiving reports from participants about erroneous market data, including overlapping bid and offer prices
	10.24 am	ASX market placed into Enquire session state. System status webpage update advised that the market was paused due to ongoing issues
	2.58 pm	System status webpage update advised that ASX would not re-open for the rest of the day, the cause of the issue had been identified and would be resolved, and trading would commence the next day at 10.00 am
	6.40 pm	ASX Market Notice published to: provide further information about the day's market data issues; confirm that all trades would stand; and advise participants how to receive the correct order book state, approach for closing and settlement prices, and that TMCs were disabled
17 Nov	10.23 am	ASX Operations started receiving reports from participants about expected Centre Point trades not being matched
	11.17 am	System status webpage update advised that, until further notice, Centre Point trade prices would be based on the ASX best bid and offer
	12.00 pm	Participants began reporting issues with mass order cancellation, with some requests only partially successful
	2.19 pm	System status webpage update advised that CHES settlement batch completion was delayed, which was delaying trade notification messages. CHES EOD commencement was delayed by one hour to 8.00 pm.
	8.30 pm	System status webpage update advised that mass order cancellation and TMC creation were disabled, while Trading Operations would support order cancellation requests on a best-efforts basis
18 Nov	8.15 am	ASX decided to disable Centre Point and Centre Point Block orders to address the unresolved issues with mass order cancellation. This update was provided on the system status webpage, which also advised that MO4 mass order cancellation was reactivated

Appendix 2: Accessible version of Figure 1

This appendix is for people with visual or other impairments. It provides the underlying data for Figure 1.

Table 1: Average bid-offer spreads across S&P/ASX 200 securities on the Chi-X market in basis points

Time	16 Nov 2020	Two-week prior average	Time	16 Nov 2020	Two-week prior average
10.01	106	110	13.00	517	22
10.10	38	36	13.10	515	21
10.20	33	26	13.20	541	22
10.30	112	25	13.30	542	21
10.40	130	24	13.40	526	21
10.50	392	23	13.50	525	21
11.00	385	23	14.00	525	21
11.10	362	23	14.10	530	21
11.20	371	23	14.20	518	21
11.30	379	22	14.30	518	21
11.40	424	22	14.40	505	21
11.50	420	22	14.50	572	21
12.00	474	22	15.00	570	21
12.10	474	22	15.10	580	21
12.20	487	22	15.20	630	21
12.30	488	22	15.30	636	21
12.40	510	22	15.40	532	21
12.50	510	22	15.50	507	21
			16.00	406	26

Note: This is the data shown in Figure 1

Key terms

Key terms

Adjust	A session state of ASX Trade where orders are not matched and participants are unable to enter orders, but are able to amend orders with some restrictions, cancel orders and report off-market trades
ASX outage	The part of the trading day after 10.24 am on 16 November 2020 when the ASX market was in the Enquire session state (also referred to as the market outage)
Centre Point orders	Hidden orders on the ASX market which match against other Centre Point orders to form trades with price improvement
CP 314 (for example)	An ASIC consultation paper (in this example numbered 314)
critical business service	Functions, infrastructure, processes or systems which, in the event of failure to operate effectively, would be likely to cause significant disruption to the participant's operations or the services it provides
Enquire	A session state of ASX Trade where orders are not matched and participants are unable to enter, amend or cancel orders, or report off-market trades
external best bid and offer (eBBO)	The data feed of Chi-X's highest bid price and lowest offer price, which ASX receives and merges with its prices to construct the NBBO
national best bid and offer (NBBO)	The pair of highest bid price and lowest offer price available across all markets
REP 509 (for example)	An ASIC report (in this example numbered 509)
Securities Markets Rules	<i>ASIC Market Integrity Rules (Securities Markets) 2017</i> —rules made by ASIC under s798G of the <i>Corporations Act 2001</i>
session state	The status of a trading platform (e.g. ASX Trade) that determines permissible functions and actions (e.g. Open or Enquire session state)
tailor-made combination (TMC)	A group of orders that will only match as trades contingent on all other orders in that group being matched at the same time: <ul style="list-style-type: none">› TMC-to-TMC matching: enables on-market crossings between a market maker and an investor in multiple instruments, or› TMC-to-outright matching: ASX generates derived bait orders that can interact with the underlying order book, to maximise execution probability and competitiveness of pricing for the TMC
trade with price improvement	A trade that arises other than from matching a pre-trade transparent order on an order book, and relies on the exception to this requirement in Rule 6.1.1(2)(c) of the Securities Markets Rules. Rule 6.2.1 outlines the permissible prices for these trades, being at least one price step better than the NBBO, or at the NBBO midpoint (also referred to as an NBBO trade or dark trade)
trading venue	A market, crossing system or other facility on which transactions are executed