Annual Report for 2019

of the Operating Committee of the Plan to Address Extraordinary Market Volatility

LIMIT UP
LIMIT DOWN

Submitted March 31, 2020

I. Introduction

On May 31, 2012, the Securities and Exchange Commission ("SEC" or "Commission") approved, on a pilot basis, a National Market System Plan, known as the Limit Up/Limit Down ("LULD") Plan, to address extraordinary market volatility. The Plan was approved by the Commission on a permanent basis on April 11, 2019, as part of the eighteenth amendment ("Amendment 18") to the Plan.[1]

The LULD Plan is administered by the LULD Operating Committee, comprising a representative from each of the Participants. The current Participants are Cboe BYX Exchange, Inc., Cboe BZX Exchange, Inc., Cboe EDGA Exchange, Inc., Cboe EDGX Exchange, Inc., the Financial Industry Regulatory Authority, Inc. ("FINRA"), Investors Exchange LLC ("IEX"), Long-Term Stock Exchange ("LTSE"), NASDAQ BX, Inc., NASDAQ PHLX LLC, The NASDAQ Stock Market LLC ("Nasdaq"), New York Stock Exchange LLC ("NYSE"), NYSE Arca, Inc. ("NYSE Arca"), NYSE American LLC ("NYSE American"), NYSE Chicago, Inc. ("NYSE Chicago"), and NYSE National, Inc. ("NYSE National"). The Plan and any amendments to it are filed with and approved by the Commission in accordance with Section 11A of the Securities Exchange Act of 1934.

As required by Amendment 18, the Operating Committee is submitting this Annual Report for the year 2019.

A. Overview

The Plan is designed to prevent trades in NMS Stocks from occurring outside specified price bands, which are set at a percentage level above and below the average reference price of a security over the preceding five-minute period. The percentage level is determined by a security's designation as a Tier 1 or Tier 2 security. Tier 1 comprises all securities in the S&P 500, the Russell 1000, and select Exchange Traded Products ("ETPs"). Tier 2 comprises all other NMS Stocks, except for rights and warrants, which are specifically excluded from coverage. The Plan does not apply to options. The Plan applies during regular trading hours of 9:30 am ET - 4:00 pm ET.

In order to determine which ETPs are eligible to be included as a Tier 1 security, the Plan requires that, on January 1 and July 1 of each year, the Participants must identify all ETPs across multiple asset classes and issuers, including domestic equity, international equity, fixed income, currency, and commodities and futures. All leveraged ETPs are classified as Tier 2 securities, and the remaining ETPs are then sorted by notional consolidated average daily volume ("CADV"). The

[1] *See* Securities Exchange Act Release No. 85623 (April 11, 2019), 84 FR 16086 (April 17, 2019) (File No. 4-631).

period used to measure CADV is from the first day of the previous fiscal half year up until one week before the beginning of the next fiscal half year. Daily volumes are multiplied by closing prices and then averaged over the period. Non-leveraged ETPs (including inverse ETPs) that trade over $2,000,000 CADV are classified as Tier 1 securities for the six-month period. The remaining ETPs are classified as Tier 2 securities.

B. Calculation of Price Bands

The Plan's price bands, consisting of a Lower and Upper Price Band for each NMS Stock, are calculated by the two securities information processors ("SIPs") – the Securities Industry Automation Corporation ("SIAC") and Nasdaq. The SIPs calculate the Lower and Upper Price Bands by applying a formula to a Reference Price, which is the arithmetic mean price of Eligible Reported Transactions over the prior five-minute period. (The first Reference Price of the day is either the primary market's opening price or the primary market's previous day's closing price/last sale when opening on a quote.) If no eligible trades have occurred in the prior five minutes, the previous Reference Price remains in effect. The Reference Price is updated after 30 seconds only if a new Reference price would be at least 1% away from the current Reference Price.

The Price Bands are calculated by multiplying the current Reference Price by the applicable Percentage Parameter, and then adding or subtracting that value from the Reference Price and rounded to the nearest penny:

Price Band = (Reference Price)+/- ((Reference Price) x (Percentage Parameter))

Table 1 below shows the Percentage Parameters in effect for all Tier 1 securities and for Tier 2 securities at or below $3.00, from 9:30 am to 3:35 pm ET. Table 2 shows the Percentage Parameters that apply to Tier 2 securities priced above $3.00 from 9:30 am to 4:00 pm ET. Price Bands are doubled during the last 25 minutes of the regular trading day for all Tier 1 securities and for Tier 2 securities at or below $3.00.[2]

Table 1: Pricing Parameters for Tier 1 Securities	
Previous Closing Price	**Percentage Parameter**
Greater than $3.00	5%
$0.75 up to and including $3.00	20%
Less than $0.75	Lesser of $0.15 or 75%

2 As discussed in Section IV below, Amendment 18 eliminated double wide bands from 9:30 am ET to 9:45 am ET for all securities and eliminated double wide bands from 3:35 pm ET to 4:00 pm ET for all Tier 2 securities priced above $3.00, effective February 24, 2020.

Table 2: Pricing Parameters for Tier 2 Securities	
Previous Closing Price	**Percentage Parameter**
Greater than $3.00	10%
$0.75 up to and including $3.00	20%
Less than $0.75	Lesser of $0.15 or 75%

Note: Pricing parameters are doubled from 3:35 pm – 4:00 pm ET for all Tier 1 NMS Stocks and Tier 2 NMS Stocks priced equal to or below $3.

C. The Operating Committee's Work in 2019

During 2019, the Operating Committee and the Participants worked to implement the elimination of double-wide bands, as set out in Amendment 18.[3] Those double-wide bands were eliminated on February 24, 2020, and the Operating Committee expects that its Annual Report for 2020 will focus in part on evaluating the results of that change.

The Operating Committee and the Participants also spent a substantial portion of 2019 revising Appendix B.II.B of Amendment 18,[4] which imposed significant new requirements on the Operating Committee to file quarterly Monitoring Reports. In July 2019, six months before the first Monitoring Report was due, the Participants advised staff of the SEC's Division of Trading and Markets that ambiguities in the language of Appendix B.II.B would make it difficult to compile the Monitoring Report, and suggested that it be amended before Participants submit any quarterly Monitoring Reports. In September 2019, the Participants provided a draft of revised Appendix B.II.B to staff, and in October and November 2019 discussed suggested revisions to the revised draft of Appendix B.II.B with staff from both the Division of Trading and Markets and the Division of Economic Risk and Analysis. Following this feedback from staff, the Participants filed the proposed twentieth amendment to the Plan on February 13, 2020. It has not yet been noticed for comment. Per agreement with staff and as requested in the Participants' request for exemptive

3 Amendment 18 eliminated all double-wide bands around the open (9:30 – 9:45 am ET) and double-wide bands around the close (3:35 – 4:00 pm ET) for Tier 2 NMS Stocks priced greater than $3.00.

4 *See* Appendix B.II.B of LULD Plan through Amendment 18, available at http://www.luldplan.com/plans.html.

relief filed on January 23, 2020, the Participants plan to file the first and second of the quarterly Monitoring Reports (covering 4Q19 and 1Q20) on April 30, 2020.

D. Annual Reporting Obligation Under Amendment 18

Amendment 18 also instituted a new obligation for the Operating Committee to prepare an Annual Report each year, the first of which is to be filed by March 31, 2020.[5] Amendment 18 provides that the Annual Report contain information concerning the Plan's performance during the preceding calendar year, including:

(1) an update on the Plan's operations;

(2) an analysis of any amendment to the Plan implemented during the period covered by the report; and

(3) an analysis of potential material emerging issues that may directly impact the operation of the Plan.[6]

We address those issues below.

II. <u>Update on the Plan's Operations in 2019</u>

Section II.A of Appendix B provides that the Annual Report include a section analyzing the Plan's operations during the prior year, and in particular, examine the calibration of the parameters set forth in the Plan and consider stock characteristics and variations in market conditions over time.

In Section A below, the Operating Committee sets out data on trading pauses, limit states, and straddle states in 2019.[7] In Section B, the Operating Committee examines the calibration of the parameters set forth in the Plan with respect to Exchange Traded Products in Tier 2, and, specifically, whether the ETPs currently in Tier 2 should be moved to Tier 1.

---

5 *Id.*

6 Please note that because data from 4Q19 is still being compiled in advance of submitting the quarterly Monitoring Report for that quarter on April 30, 2020, a complete set of 4Q19 data was not available at the time the Operating Committee prepared this Annual Report.

7 As defined in Section VII(A)(2) of the LULD Plan, a "straddle state" is when the national best bid is below the lower price band, or the national best offer is above the upper price band, and the security is not in a limit state, and trading in that security deviates from normal trading characteristics such that declaring a trading pause would support the LULD Plan's goal to address extraordinary market volatility.

A. Data on Trading Pauses, Limit States, and Straddle States in 2019

Activity in 2019 was marked by low volatility. The intraday peak VIX® was a very low 28.53 and the closing high was 25.45, and the average close for VIX® was 15.39.[8] Accordingly, the observed number of pauses, limit states, and straddle states was relatively low, and no significant market events took place during 2019.

Table 3 below shows the number of trading pauses, limit states, and straddle states across all exchanges for the first nine months of 2019 (January through September). This data has already been submitted to the SEC pursuant to the Participants' pre-Amendment 18 obligation to provide certain data to the SEC on a monthly basis. As noted above in note 4, the data for 4Q19 is currently being compiled pursuant to Amendment 18's new quarterly Monitoring Report requirement, and will be summarized and aggregated for the SEC in a 4Q19 Monitoring Report to be submitted on April 30, 2020.

The data from January through September 2019 shows the following:[9]

Table 3	Limit State, Trading Pause and Straddle State 2019 Q1 - Q3 (excl. 8/12/2019)		
Daily	**Limit**	**Pause**	**Straddle**
Average	196	10	1,782
Median	78	9	1,286
90th %-ile	280	19	3,202
Low	4	1	431
High	7,443	57	9,438

B. Price Bands for ETPs Currently in Tier 2

For this Annual Report, the Operating Committee has focused on evaluating the calibration of the parameters set forth in the Plan with respect to ETPs in Tier 2, and, specifically, whether the ETPs currently in Tier 2 should be consolidated into Tier 1. The Participants initially undertook this study at the request of the issuers of ETPs who are concerned about the harm to investors caused by sharp moves in their products' prices when execution prices diverge from their indicative index value. The purpose of the Participants' analysis was to discover whether the price protection provided by narrowing the bands on Tier 2 ETPs would result in an unreasonable disruption in trading, thereby hampering the price discovery process.

---

8 In comparison, the intraday peak VIX® during February 5-7, 2018 -- noted high volatility trading days -- was 50.3.

9 Please note that due to a SIP outage on August 12, 2019, that date has been omitted from this data.

The Participants, in conjunction with the Plan Advisors and ETP issuers, studied the potential impact of recategorizing all ETPs currently in Tier 2 into Tier 1, such that they would be subject to narrower Price Bands. The Participants previewed this topic to SEC staff at a meeting of the LULD Plan Operating Committee on February 25, 2020. The following study supplements that presentation, and provides additional data bearing on the question of whether any ETPs should remain in Tier 2, or whether the operation of fair and orderly markets would be enhanced by moving all ETPs to Tier 1.

The study's methodology is summarized in Point 1 below. Point 2 presents the results of the study with respect to ETPs. In Point 3, we compare the results for leveraged vs. non-leveraged ETPs. In Point 4, we compare the impact that would occur if non-ETP ("corporate") Tier 2 securities were similarly subjected to the narrower Tier 1 bands. The study covers all of 2018 and 2019; 2018 was marked by higher volatility overall and one notable volatility event involving VIX®-related ETPs on February 5-7, 2018, so including 2018 allowed for the comparison of a period of high volatility with the low volatility of 2019.

1. Methodology

For the study, the simulated LULD bands were calculated for Tier 2 ETPs as follows:

1. Determine the mid-point of the lower and upper LULD bands.
2. For periods during the first 15 and the last 25 minutes of core hours, the band width was decreased by 75% to account for the transition of these Tier 2 ETPs into Tier 1 and the elimination of double-wide bands in Amendment 18. This allows for maintaining leverage factors without tracking which securities were leveraged. During all other time periods, the band width was decreased by 50%.
3. All securities that had a prior day close at or below $3.00 were excluded as these securities are subject to the same pricing parameter for both Tier 1 and Tier 2.

Once the bands were calculated, the Participants tracked all executions that occurred at prices between the simulated bands and the actual bands. We then categorized all trades within the same clock minute as an "incident." We further tracked the number of shares traded in each incident, the dollar value of the trades, and the distance from the proposed narrowed bands at which the trades took place.

2. Results for ETPs Currently in Tier 2

The LULD Plan was designed to reduce extraordinary transitory volatility. The purpose of the Participants' study was to discover whether narrowing the bands on Tier 2 ETPs to mitigate the potential for bad executions on volatile days would result in an unreasonable disruption in trading on normal trading days, thereby hampering the price discovery process.

The study showed, in Table 4 below, that there were typically very few trades per day that were executed beyond the simulated bands, and that these trades were generally small in size, indicating that they were likely made by retail customers.

Additionally, most of the trades executed beyond the simulated bands occurred over a period of three days during the VIX®-related volatility event on February 5-7, 2018. The simulated incidents for those days accounted for:

- 87% of all trades between the simulated and actual bands
- 91% of all shares between the simulated and actual bands
- 83% of the total dollar value between the simulated and actual bands

In addition, during February 5-7, 2018, just two VIX®-related ETPs accounted for:

- 85% of the value traded between the simulated and actual bands
- 97% of all trades that violated the simulated bands

Table 4: Summary Statistics of Potential ETP LULD Events with Simulated Tighter Bands

		All ETPs		Leveraged ETPs		Non-Leveraged ETPs	
Daily Results		**All Dates**	**Exclude Feb 5-7**	**All Dates**	**Exclude Feb 5-7**	**All Dates**	**Exclude Feb 5-7**
Symbols Impacted	**90th %-ile**	14.9	14.0	7.0	7.0	9.0	9.0
	Median	7.0	7.0	3.0	3.0	4.0	4.0
	Average	8.3	8.1	3.5	3.3	4.9	4.7
Incidents	**90th %-ile**	28.0	28.0	10.0	10.0	18.9	18.0
	Median	10.0	10.0	4.0	4.0	6.0	6.0
	Average	20.5	14.0	9.5	4.9	11.0	9.0
Trades	**90th %-ile**	39.9	39.0	16.0	16.0	25.9	25.0
	Median	13.0	13.0	4.0	4.0	7.0	7.0
	Average	147.8	19.1	131.5	7.0	16.3	12.1
Dollar Value	**90th %-ile**	$180,394	$176,409	$67,960	$66,992	$109,074	$106,728
	Median	$35,347	$35,165	$7,349	$7,325	$17,208	$16,956
	Average	$583,987	$99,685	$498,181	$28,860	$85,806	$70,825

It is important to highlight that just because a trade would have been prevented by the narrowed bands in a simulated event does not mean that trading pauses would increase during actual trading under these bands. First, we note that most incidents involved three or fewer trades, and the median trade size was 100 shares (see Table 5 below). The 90th percentile trade size was only 400 shares. Just as market makers provide liquidity now near the bands, the Participants expect a similar behavior, which could be expected to prevent a noticeable increase in LULD pauses.

Table 5: Trade Size Comparison		
	All ETPs	
	All dates	**Exclude 2/5 - 2/7**
Average	238	171
Median	100	59
90th %-ile	400	300
	Leveraged ETPs	
	All dates	**Exclude 2/5 - 2/7**
Average	243	129
Median	100	58
90th %-ile	400	278
	Non-Leveraged ETPs	
	All dates	**Exclude 2/5 - 2/7**
Average	197	194
Median	85	60
90th %-ile	300	300

Second, in light of the expectation that market makers would provide liquidity at or near the new simulated bounds, the daily dollars protected likely represents an upper bound. For instance, on February 24, 2020 -- the date on which the opening and closing double-wide bands were eliminated under Amendment 18 -- market makers adjusted their pricing to the new bands. Some volume would execute at prices at or below the simulated bands. The lower bound of dollars protected is represented by the assumption that all volume would have executed at the simulated bands. If that occurred, more than $5 million in trades still would have been protected on February 6, 2018, while the daily dollars saved would be closer to $1,200.[10] This further strengthens the argument that narrowing the bands for Tier 2 ETPs would protect investors when prices move out of line due to extreme volatility, while causing no harm at other times.

---

10 The $5 million calculation is considered a lower bound for dollars prevented by tightening the bands. The dollar value noted in Table 4 is the shares executed outside the hypothetical bands but inside the existing bands. The $5 million calculation assumes that these trades would all have occurred, but instead calculates the dollar savings as the price of the execution versus the nearby band. For example, if the hypothetical band was $10.00 and we executed 100 shares at $10.10, Table 4 would consider the dollar value to be $1,010. However, this statistics would be 100*($10.10 - $10.00) = $10. This still assumes all of the trades would have executed, but at the band price. In actuality, many of the trades may not have executed at all, which is why we consider this a lower limit for dollars saved.

3. Comparison of Leveraged and Non-Leveraged ETPs

As noted above, trading on February 5-7, 2018 accounted for nearly 90% of all incidents found during the 2018-2019 period, and 99% of the trades on those three days that could have been protected were in leveraged ETPs. The Participants also reviewed the results for both leveraged and non-leveraged ETPs for the two years under consideration.

We compared daily security counts, number of incidents, number of trades and dollar value executed in trades outside the simulated bands, but inside the bands that existed at that time. Excluding the three days noted above, leveraged products accounted for a significant, but much smaller share of activity captured by our analysis:

- 42% of all securities impacted were leveraged products
- 35% of all incidents were from leveraged products
- 36% of all trades were from leveraged products
- 29% of the dollar valued traded were in leveraged products

We also compared the typical trade size for leveraged and non-leveraged ETPs that could have been prevented by narrower bands. The median trade size for leveraged products, excluding the February 5-7, 2018 period, was smaller than non-leveraged products. The overall average is larger (243 shares versus 197), as there were many larger trades during the affected period, when leveraged products were impacted.

4. Analysis for Non-ETP Securities

To provide a basis for comparison, the Participants also reviewed trades that would have been prevented by tighter simulated bands for non-ETP securities. We observe far more possible executions outside the bands, impacting more than 100 securities each day. Unlike ETPs, individual securities cannot be as easily hedged as an index. For example, while the study showed that the median number of securities impacted among ETPs with simulated Tier 1 bands during the period was only ***7*** (as shown in Table 4 above), ***117*** non-ETPs currently in Tier 2 would have been impacted by narrower bands. Similarly, while for ETPs, the median number of daily incidents was ***28***, there were ***326*** such incidents when Tier 2 non-ETPs were subjected to the narrower bands in the study. Further, the median number of daily trades for Tier 2 ETPs with simulated Tier 1 bands was only ***13***, compared to nearly ***4,000*** per day for Tier 2 non-ETPs with simulated Tier 1 bands -- more than 300 times more.

Table 6: Non-ETP Summary	Trades	Securities	Incidents
Average Daily	7169	127	361
Median Daily	3981	117	326
90th percentile	16302	185	561

We also considered the activity for the three days from February 5-7, 2018, which had a major impact on the results for ETPs. Of the 502 days in our survey, the highest rank, in number of trades impacted, was 123. February 6, 2018 did account for the 14th highest number of securities impacted and the 33rd highest number of incidents. However, the number of incidents and trades ranked much lower, as shown in Table 7 below.

Table 7: Feb. 5-7 Ranks	Trade Rank	Security Rank	Incident Rank
Feb. 5, 2018	155	86	275
Feb. 6, 2018	123	14	33
Feb. 7, 2018	351	105	372

The Participants believe that, based on these statistics, narrowing the bands for Tier 2 non-ETPs could cause substantial market disruption. Market makers cannot as easily off-set their positions, and while we would expect some additional liquidity to be posted at the tighter bands, the risk of a substantial increase in LULD pauses would make such a change risky. In contrast, the impact from moving ETPs to Tier 1 appears to be limited.

5. Conclusion

The Participants' study preliminarily finds that narrowing the LULD bands for Tier 2 ETPs may be consistent with the goals of the LULD Plan. It may protect investors from bad fills on volatile trading days, while minimizing disruption on normal trading days. Additionally, because there may be Tier 2 ETPs that are based on the same index as Tier 1 ETPs, consistent treatment of these ETPs may help prevent inconsistent application of limit states and halts across similar ETP products.

The study also preliminarily shows that narrowing the bands on Tier 2 non-ETP securities could potentially create far more numerous trading disruptions, due to the greater volatility of individual securities. It follows from widely-accepted Modern Portfolio Theory that most ETPs will experience less volatility than individual securities, suggesting that many deviations from the prescribed bands are due to temporary imbalances in less liquid securities, which narrower bands could fairly and effectively largely eliminate.

In addition to the naturally lower volatility of a portfolio of securities, while professional customers may be able to hedge or neutralize positions in a paused ETP via the cash or futures markets, this avenue is typically not available for an individual stock. Pausing individual stocks would cause far more significant disruption events than pausing a less liquid ETP.

Note that these results are preliminary. This analysis does not include 2020, and in particular the volatility experienced starting in the last week of February 2020 as the market responded to coronavirus news. We will need to analyze that data and any other recent data before arriving at a conclusion, and this work is ongoing.

III. **Analysis of Amendments Implemented**

Section II.A of Appendix B also states that the Annual Report will provide an analysis of any amendments implemented during 2019, including the amendment's operation and its impact on the overall operation of the Plan.

Amendment 18, approved by the Commission on April 11, 2019, comprises three changes to LULD Plan.

1. Plan moved from Pilot to Permanent status.
2. Data requirements including the quarterly and annual report
3. Elimination of double wide bands from 9:30 to 9:45 am for all securities and elimination of double wide bands from 3:35 to 4 pm for all Tier 2 securities priced above $3.00.

The transition from Pilot to Permanent status occurred upon SEC approval of Amendment 18 in April 2019. There is no observable impact of this transition. The elimination of double-wide bands went into effect on February 24, 2020. Preliminarily, the Operating Committee has observed no negative impact resulting from these functional changes. A detailed analysis of the operation and impact of those changes will be included in the Annual Report covering 2020.

IV. **Analysis of Emerging Issues**

As noted above, 2019 was marked by low volatility and presented no significant market events for analysis. There are no previous Annual Reports to analyze for comparison.