
Consultation response

PRA CP5/18 Algorithmic trading

4 May 2018

The Association for Financial Markets in Europe¹ (AFME), Futures Industry Association² (FIA) and UK Finance³ (collectively, the Associations) welcome the opportunity to comment on the **PRA Consultation Paper entitled Algorithmic trading – CP5/18**. We set out below our general remarks relating to the consultation, which are followed by comments on the PRA's draft supervisory statement on algorithmic trading.

Executive Summary

The Associations support measures by the PRA to ensure that firms that engage in algorithmic trading, apply the appropriate risk controls and that appropriate governance arrangements are in place. However, the CP raises a number of important questions and concerns and we ask that the PRA address several key points in the proposals before proceeding further. These key points include:

- Timing - in our response we explain why the effective date of 30 June 2018 - just six months after the implementation of MiFID II and only seven weeks following the deadline for responses to CP5/18 - is problematic and challenging for firms.
- Clarity – following a thorough and detailed discussion with members from across our memberships, we have identified several areas where we would welcome greater clarity on the intention and scope of the proposals.
- Regulatory consistency – we note that the FCA published a statement on algorithmic trading at the same time as the PRA; we wish to stress that both papers should be aligned to prevent regulatory inconsistency.

¹ AFME represents a broad array of European and global participants in the wholesale financial markets. Our members comprise pan-EU and global banks as well as key regional banks, brokers, law firms, investors and other financial market participants. We advocate stable, competitive, sustainable European financial markets that support economic growth and benefit society.

² FIA is the leading global trade organization for the futures, options and centrally cleared derivatives markets, with offices in London, Singapore and Washington, D.C. FIA's membership includes clearing firms, exchanges, clearinghouses, trading firms and commodities specialists from more than 48 countries as well as technology vendors, lawyers and other professionals serving the industry.

³ UK Finance represents nearly 300 of the leading firms providing finance, banking, markets and payments related services in or from the UK. UK Finance was created by combining most of the activities of the Asset Based Finance Association, the British Bankers' Association, the Council of Mortgage Lenders, Financial Fraud Action UK, Payments UK and the UK Cards Association. Our members are large and small, national and regional, domestic and international, corporate and mutual, retail and wholesale, physical and virtual, banks and non-banks. Our members' customers are individuals, corporates, charities, clubs, associations and government bodies, served domestically and cross-border. These customers access a wide range of financial and advisory products and services, essential to their day-to-day activities. The interests of our members' customers are at the heart of our work.

- Gold-plating & harmonisation - some of the proposals go beyond the MiFID II/MiFIR requirements, specifically in respect of RTS 6, creating operational inconsistencies and additional requirements for firms operating across European Union Member States. This in turn compromises harmonisation of the legislative framework across Europe.
- Proposed drafting amendments – please see the Appendix at the end of our response where we include some examples of proposed drafting amendments.

We would be very happy to discuss any aspect of our response with the PRA. We have prioritised working on our response to CP5/18 but may also request to speak with the FCA on their approach to algorithmic trading.

Timing

- The PRA proposes that the algorithmic trading supervisory statement (SS) applies from Saturday 30 June 2018 less than six months from the MiFID II/R go-live that introduced a comprehensive set of new requirements for firms, including for algorithmic trading. This also involved costly system upgrades and builds that took a significant amount of time for firms to implement.
- Recognising that the date for responding to the CP is 7 May 2018, we are concerned that the 30 June 2018 timeframe for adjusting to new expectations does not enable the PRA to give due consideration to comments made by respondents to the CP.
- To the extent the final SS does not require firms to undertake any work additional to that they would have had to undertake to be compliant with RTS 6, then the 30 June 2018 application date is achievable by firms. However, if the intention is to go over and above the requirements of RTS 6, then the PRA's supervisory expectations should reflect the fact that systems changes originally implemented for RTS 6 would have happened over an extensive time horizon.
- We wish to stress that FCA and PRA regulated firms remain heavily focused on working through various MiFID II implementation challenges.

Clarity

- We recognise that CP5/18 seeks to make clear the PRA's expectations of firms in respect to the governance and risk management of algorithmic trading. However, as drafted several of the CP proposals would benefit from additional clarity and information on the scope of the proposals. Please refer to Sections 1-6 of our response for detailed comments.

Regulatory consistency

- CP 5/18 and the FCA paper discuss similar topics, yet from different perspectives. We note that CP 5/18 addresses the potential for algorithmic trading to have a financial impact on the firm, whereas the FCA paper focuses on market integrity.

It is important for regulators to have aligned views in respect of their requirements for algorithmic trading so that firms can better target their resources when developing the core principles of their governance and risk management policies. To that effect, we strongly encourage the PRA to take a

principles-based approach that may defer to existing regulation within the same space if it is considered adequate, especially where regulation has been recently implemented.

1. **Governance**

- 1.1. We support a strong governance framework for all aspects of electronic trading, including algorithmic trading as well as the provision of electronic access to markets by a firm's clients. Governance should set principles for how firms approach different functions including both the use and provision of electronic or algorithmic trading, yet that governance framework should be flexible enough to reflect that there may be differences within the firm in how those functions are implemented, and indeed the size of the firm.
- 1.2. We are concerned by Section 2.2 of the PRA's draft SS which requires firms' management bodies to adopt a specific governance framework with respect to firms' algorithmic trading and associated risk controls. We would like to highlight that firms have varied business models and structures with risk management strategies and frameworks aligned to the various businesses they operate (which businesses may or may not contain electronic or algorithmic trading). Such risk management strategies and frameworks take into account the nature, scale and complexity of each individual business and are done to ensure that risks arising from a particular business are considered in the round and would take all relevant risk factors applicable to the business area into account, including the level of electronification/algorithmic trading. Expecting firms to split out algorithmic trading and adopt a framework outside the context of a relevant business unit may lead to the production of non-relevant statements that are difficult to apply in practice and would lack the relevant context of the risks posed to the firm as a result.
- 1.3. Regarding Section 2.7(d), we believe that the inclusion of both terms "testing" and "validation" generates a standard which is not representative of the requirements of RTS 6. Validation would normally require a formal assessment with additional procedural steps. We would therefore recommend reverting to a text that tracks closely the requirements of RTS 6 and refers to "testing and annual validation processes"
- 1.4. Ultimately, we would expect the final SS to provide flexibility regarding how firms implement their governance framework, as well as the understanding that multiple business units may require parallel senior management responsibility – especially where there may be deliberate information barriers between different business units. This responsibility includes ensuring that traders within their domain are appropriately trained to understand how their systems interact with the market and operate within the appropriate risk framework adopted by the firm.

2. **Algorithm approval process**

- 2.1. We support the utilisation of a robust approval process for the introduction of any new algorithmic trading system into live markets. Appropriate due diligence leading up to approval plays a fundamental role in the prevention of poorly implemented systems entering production.

This is not just true of an algorithmic trading system, but also of any system that is implemented within live markets, which may inadvertently cause disruption to the function of the market or jeopardize market integrity.

- 2.2. Despite the robust approval procedures implemented by firms, there is still the possibility that a system may not function as intended - particularly in times of market stress; to that effect the governance framework should also ensure that there are appropriate real-time monitoring and risk control requirements for any system deployed into production, regardless of the testing and appropriate review prior to deployment.
- 2.3. We also emphasise the need for both proportionality and materiality with regard to how changes – including amendments and customisations - are approved and introduced into this process based upon the relative size of a firm and its complexity. We also note the increased usage of independent software providers in the development and provision of electronic and algorithmic trading systems.
- 2.4. In light of the above, we would like to highlight some concerns relating to the PRA’s statements on firms’ algorithmic approval process. Section 3.1 suggests that an algorithm approval process should capture new algorithms as well as “customisation of, or amendment to, existing algorithms”. This is not in line with Article 5(1) of RTS 6 which requires this process to be applied prior to the deployment or “substantial update” of an algorithm. The draft SS appears to set the expectation for the entire process to be applied to all updates (regardless of materiality) and also to any “customisation” of an algorithm. The Associations strongly believe that language similar to that used in RTS 6 should be adopted in the SS. As drafted, this proposal suggests gold-plating, in which case we would expect to see full and thorough consultation with industry. If this is not the intention, we ask the PRA to make that clear.
- 2.5. In relation to Section 3.3(c), we believe that all risks inherent in automated trading should be considered during the approval process by staff with appropriate algorithmic trading expertise. We note that Article 2(1) of RTS 6 requires Compliance staff to have a “general understanding of how the algorithmic trading systems and trading algorithms of the investment firm operate”, suggesting that this function would not have the relevant expertise to sign off on all aspects of algorithm development and roll out. We seek clarity as to the extent the PRA has expectations for specific functions to sign off on algorithms and confirmation that the PRA is not seeking to go beyond the scope of RTS 6.
- 2.6. The Associations also have concerns around the expectation for firms to sign off on these risks “under both normal, and severe but plausible conditions”. Whilst we support the requirement for firms to understand the risks generated by algorithms, the risk factors for algorithmic trading are diverse in nature. We therefore request that the PRA generalises this requirement or permit periodic stress test frameworks to cover the spirit of this guideline.
- 2.7. In Section 3.4, the PRA sets out its expectations for firms to have risk controls that limit exposure to a “counterparty, order attribution, message rate, frequency of orders, stale data and order and

position size". It is not clear whether the PRA expects firms to implement controls in addition to those required by RTS 6. If this is the case, the Associations would appreciate additional clarification of what the terms it uses mean (including, for example, "order attribution" and "stale data"). More broadly, we encourage the PRA to use the terminology used within RTS 6.

- 2.8. Furthermore, the draft SS states that firms should "periodically assess kill switch controls to ensure they operate as intended". It is not clear from the draft SS what level of periodicity is required, however the Associations note that firms are already required to do this by virtue of the annual assessment that firms have to conduct pursuant to Article 9 of RTS 6.

3. **Testing and deployment**

- 3.1. We support the proposal that all algorithms and risk controls be tested prior to deployment and subject to periodic re-validation. Any algorithm that does not operate as intended can have unintended consequences for both the firm deploying it, as well as other market participants.
- 3.2. We note, however, that testing may not be inclusive of all potential scenarios, and the role of risk controls is intended to mitigate the effects of unanticipated behaviour. The important role of pre-trade risk controls implemented for any form of electronic trading cannot be understated, and such controls should be appropriately implemented at various levels – not just by the firm engaged in algorithmic trading, but potentially also by the firm providing access to the market (if different) and at the trading venue itself to mitigate the impact of activity that may be disruptive and harmful to both the market and the firms.
- 3.3. We also note that development and testing may not be easily segregated within different types of firms. We agree that development and testing should be segregated from deployment into production, however smaller firms (or business units) may require development and testing to be comingled, however, the role responsible for assuring that test results are successful should be distinct from the developer(s) who performed the code changes. The ability to provide flexibility around development and testing roles is an important point regarding proportionality of how proposed supervision can be implemented.
- 3.4. Section 4.1 of the draft SS sets out the expectation that "all algorithms (including those provided by external vendors) and risk controls be tested prior to deployment". Where the firm uses outsourced vendor software or hardware for algorithmic trading, there are inherent challenges in having the same level of involvement or control in designing, developing and testing as one would with an in-house system. We propose that the PRA acknowledge that under RTS 6, firms are not necessarily required to have conducted the entire suite of testing themselves but rather to have "sufficient knowledge and the necessary documentation to ensure effective compliance" with the relevant requirements. We also propose that the PRA amend the final sentence of Section 4.1 to read "testing should validate that the algorithm is operating according to its design" on the basis that it is not the role of the tester to "assess" the algorithm's design.

- 3.5. The Associations are also of the view that the PRA's reference to the revalidation of algorithms in Section 4.2 does not clearly track the requirements of Article 9 of RTS 6, where a clear process for validation is set out.
- 3.6. On the role of different functions in the design and sign off process (Section 4.3), we agree that risk management and other systems and controls functions have a role to play in providing a check on the risk controls used in relation to algorithmic trading. However, we note that these functions typically have the role of ensuring that appropriate frameworks and procedures are in place to facilitate the implementation of automated risk controls.
- 3.7. Not all automated controls are relevant to all Risk/Control Functions and so the involvement of each Function need only be when activity is relevant to the risks they oversee. Furthermore, many second line of defence controls are in downstream systems and operate on all activity, irrespective of the front office algorithm used. Therefore, separate testing for each algorithm is not always needed and we request that the PRA allow for flexibility for this determination to be made internally in order to prevent unnecessary duplication of testing. We also note that these controls are complex and require specialist skills to assure their design and effectiveness. We also propose that the PRA permit firms to determine the appropriate functions responsible for such testing within their own proportional governance framework.
- 3.8. With regard to Section 4.4, the Associations assume that by "any variation of an algorithm (for example, regional variation) should be classified as a new algorithm" the PRA follows the approach set out in Article 5(5) of RTS 6, which states that "an investment firm shall undertake further testing if there are substantial changes to the algorithmic trading system". We also note that "regional variation" is not a necessarily a substantial model change. Differences between individual trading venues (inter or intra-regionally) often lie in the messaging protocols used by the venues to transmit market data and receive orders. Trading algorithms do not generally deal with these protocol differences directly but where the algorithms themselves must be adapted to the individual micro-structure of a (regional) market and then these situations should be tested with the relevant market, where material. We therefore propose that this example is removed and recommend that firms are permitted to judge the materiality of a change when defining what constitutes a "substantial change" which would be required in order to justify a firm undertaking any further testing of an algorithm.
- 3.9. In relation to the individuals carrying out testing of algorithms, the Associations request that the PRA provide further clarity on what is meant by "a competent team that was not involved in the development (including implementation) of the code" as stated in Section 4.5(a). The Associations note that in order to be competent to understand and carry out testing, teams or individuals will naturally be involved in the development and implementation of algorithms. Furthermore, knowledge gained by being involved in development (including various reviews and challenges) provides invaluable experience which contributes to a team or individual's ability to demonstrate competency to test.

- 3.10. The Associations therefore requests that Section 4.5(a) be amended to state that testing should be reviewed by a competent team who are not responsible for the coding of algorithms, integration of that code into the system or releasing that code into production.
- 3.11. Section 4.5(b) states that the PRA expects testing to be undertaken “with any differences between the test environment and the production environment being included in the testing documentation”. Whilst we are highly supportive of the consideration of both test and production environments within testing procedures, we note that the recording of “all differences” between the two will require firms to take into account the number and nature of trading venues/platforms, instruments covered, volumes, types of orders received and sent as well as the replay of exceptional events (among other variables). Such an expectation will bring about the documentation of a significant number of differences with proportionately little benefit added through the procurement of such information. In light of the above, we request that the PRA remove Section 4.5(b).
- 3.12. With regards to assessing latency and capacity within the algorithmic trading systems and dependent systems such as risk controls (Section 4.6), we note that these go beyond the requirements of RTS 6. The Associations therefore suggest that expectations are set as part of the annual self-assessments set out in Article 9 of RTS 6, as well as requirements for real-time monitoring as part of Article 16 of RTS 6.
- 3.13. Section 4.7 of the draft SS sets out the PRA’s expectation for firms to “assess the operational arrangements at the trading venue and determine whether actions should be taken to ensure that the algorithmic trading system operates as intended and, if necessary, what these actions should be”. Can the PRA confirm that conformance testing carried out in line with Article 6 of RTS 6 would satisfy the requirements in relation to assessing “the operational arrangements at a trading venue”?
- 3.14. The Associations would appreciate further clarification on what is meant by “infrastructure provided by an external vendor” which is referred to in Section 4.8 of the draft SS. We note that this term could refer to a number of different types of systems, agreements and arrangements with external vendors.
- 3.15. With reference to Section 4.9 on errors identified in the testing process, we would appreciate clarification on what constitutes “the tracking and documenting of outstanding issues to an auditable standard”. Firms typically retain test scenarios and results and any algorithms identified as not functioning as required would generally not be approved for deployment. We also note that test output is used to inform further development.

4. Inventories and documentation

- 4.1. The PRA proposes that firms create and maintain comprehensive inventories of algorithms and risk controls, as well as documentation that sets out the algorithm’s strategy and risk mitigants, kill-switch control procedures and underlying trading system architecture. This allows others

within the firm to understand and challenge potential risks. While we fully support the principles behind these requirements, we note that business units within firms often have different objectives in the roles they engage in or provide to others which may not neatly fall into a single inventory or documentation objective – especially when there may be information barriers between units. Additionally, a single inventory of algorithms, risk controls and documentation may create intellectual property and security challenges and goes beyond the requirements set out in RTS 6. We therefore seek confirmation that the PRA do not intend to go beyond the scope of MiFID II in relation to the creation and maintenance of inventories of algorithms and risk controls.

- 4.2. As we have noted before, the overall governance framework within the firm should ensure that appropriate policies are implemented that require business units to maintain inventories and documentation, yet the framework should not require collation in a single place but rather require presentation of appropriate inventories on demand from a regulator.
- 4.3. With consideration of our concerns relating to inventories of algorithms and risk controls, we request that the PRA consider whether it would be acceptable to maintain a centralised inventory of risk controls which contains core details such as name, description and status. Meanwhile other system specific details (such as limit configuration) will be stored within the application algorithmic platform. In addition, flexibility should be permitted on requiring “a single” inventory of controls as different firms have different organizational setups which may make it more efficient to have separate (multiple) control inventories in each risk function, which should suffice if in aggregate firms are able to provide the complete set of controls.
- 4.4. Regarding the maintenance of inventories and documentation, Section 5.2(b) sets out the expectation that documents are “updated at least annually”. While the regular updates of some of those documents are sensible, the Associations question whether it is necessary to update them all (for example, if there is no change to an algorithm during the course of a year, it does not make sense to update “documents relating to each algorithm’s strategy and risk mitigants”. The Associations suggest that Section 5.2 require that inventories and documents be “reviewed at least annually and updated if necessary”.
- 4.5. In relation to Section 5.2(c), the Associations believe it is sufficient to state that inventories should be “accessible by all the firm’s personnel who have responsibility for the oversight of algorithmic trading”. It is not clear what the word “immediately” requires and the Associations therefore propose that the PRA remove this word from the requirement.
- 4.6. With respect to Section 5.3(d), the Associations note that not all algorithms are approved “in terms of region, asset class, instrument, desk or portfolio” and so recommends “(where applicable)” be added to the end of that list.
- 4.7. Section 5.4 sets out a “minimum” standard with respect to firm’s inventory of risk controls. The Associations believe that this standard is too complex and unnecessarily prescriptive. The list is not necessarily relevant for every individual control that resides in separate second line of

defence functions. It should be rephrased as a guideline and flexibility should be permitted to meet the spirit of this paragraph. For example, there is no single individual “owner” that is responsible for counterparty and market risk limits; it is a department-wide responsibility with senior management and/or committee escalation triggers.

- 4.8. We note that the draft SS sets out far more granular expectations on the content of kill switch procedures (Sections 5.8-5.10) when compared to those set out in Article 12 of RTS 6. We request clarification as to whether the PRA intends to go beyond the scope of RTS 6, and if not, we propose the language used in Sections 5.8-5.10 closely follow the wording provided in the existing regulation.

5. **Risk management and other systems and controls functions**

- 5.1. The PRA proposes that each firm’s risk management function (independent of the front office) have oversight of the risks of algorithmic trading, with the expectation that this function as well as Other Systems and Controls functions have the authority and expertise to challenge front-office staff and impose whatever additional risk controls are necessary for effective risk management of algorithmic trading.
- 5.2. While we are fully supportive of the view that there should be appropriate oversight of any type of activity, regardless of whether it is algorithmic in nature or not, we would again note that such oversight should be commensurate to the type of activity that is being engaged in, and a single risk framework may not be appropriate across varied business units. For example, a business unit within a firm that engages in algorithmic based principal trading should have appropriate risk management oversight for the risk that it may pose to the firm. By comparison, a business unit that provides electronic or algorithmic trading services for clients should have the appropriate risk management oversight for the risk that these services may pose to firm.
- 5.3. With regard to the role of different functions in relation to algorithmic trading, we note that Section 6.1 sets an expectation for risk management and other systems and controls functions to “understand algorithmic trading being undertaken at the firm, the risks that such trading exposes the firm to, and how it affects their oversight responsibilities”. We note that Article 2(1) of RTS 6, only requires for the compliance function to have a “general” understanding of how algorithmic trading operates. Moreover, Article 3(4) of the same regulation states that staff responsible for risk and compliance functions are only required to have “sufficient knowledge of algorithmic trading and strategies”. There is no requirement within MiFID II for other systems and controls such as Operations and Settlements to have an understanding of algorithmic trading or authority to challenge/restrict it. We therefore request that requirements of Section 6.1 are specified not to apply to Operations and Settlements which are called out as “Other Systems and Control Functions” by Section 6.13.
- 5.4. With regard to the expectation set out in Section 6.3 that the Risk Management function “ensure” that algorithmic trading is consistent with the firm’s risk appetite, we would suggest that this be re-worded to more accurately reflect the role of the Risk Management function as described in

Article 17(1) of RTS 6, which is to monitor post-trade controls and identify when algorithmic trading may not be consistent with the firm's risk appetite and take appropriate action.

- 5.5. The Associations are concerned by the PRA's proposal that Risk Management functions should "manage the potential concentration of risk arising from counterparties using similar trading strategies". It is not conceivable that firms will know and/or understand the strategies of algorithms being utilised by such counterparties. Moreover, we would have competition concerns regarding any proposals that suggest that firms should request information from counterparties in relation to the functioning of their algorithmic strategies. We therefore request that the PRA remove Section 6.6.
- 5.6. Section 6.7 of the draft SS states that the Credit Risk Management function "should assess the suitability of counterparties with direct electronic access". The Associations note that in the context of the type of trading being undertaken for DEA clients, the Credit Risk function would not typically be involved in assessing individual clients provided that limits are applied to such clients in line with the firm's credit risk framework and "per client" or "client type" limits. As set out in our general comments above, firms should have appropriate risk management oversight that reflects the credit risk that these services may pose to firm (and which take into account not only the service/method of access but also other appropriate factors such as the level of financing involved).
- 5.7. Sections 6.8, 6.10, 6.12 refer to PRA expectations for Risk Management to identify, assess and report on risks arising from the operation of algorithmic trading architecture. An assessment of system architecture not operating as intended requires specialised technology skills that (depending on organisational setup) may not necessarily reside within the Risk Management department. We also note that risk identification and software code testing is primarily a first line responsibility which is reviewed and challenged by the second line of the Risk Management function. We propose that the PRA allows firms to determine which departments should be responsible for adhering to these requirements (including allowing this to be done by a first line function with oversight by a second line function).
- 5.8. Section 6.11 of the draft SS states that "the Risk Management function should formulate and execute mitigation plans" in respect of identified risks that would arise if parts of the algorithmic system architecture do not operate as intended. System malfunction is already part of Business Continuity and Contingency Planning and the PRA paper should allow this to remain the case and to be performed by appropriate departments based on firm's organisational structure. Mitigation plans for system failures should remain with the system owners (first line of defence) with appropriate oversight from second line and/or third line functions, as per other system infrastructure oversight.
- 5.9. In relation to the role of the Compliance function, the PRA states in Section 6.14 that the "Compliance Function should ensure that its algorithmic trading activities comply with the PRA Rulebook and meet the expectations set out in this SS". The Associations views this statement as an inappropriate and indirect extension of the Compliance function (as a control function) to an

executive function. We also note that this is an explicit deviation from the approach taken in Article 2 of RTS 6. Placing the ultimate responsibility on Compliance may turn this function into a “significant harm function” - specifically SHF 9 – which, we believe, is not the intention. We therefore request that this section is removed or amended to reflect the that the Compliance function is only in a position to assist in the establishment of an appropriate framework (in which it will carry out its own functions).

6. We would be happy to discuss any of the points made in this response with you in further detail if that would be helpful.

AFME contacts:

April Day,

Managing Director, Equities Trading

+44 (0)20 3828 2682

april.day@afme.eu

Sean Barwick, Equities Trading

+44 (0)20 3828 2670

sean.barwick@afme.eu

Louise Rodger, Director, Compliance

+44 (0)20 3828 2742

louise.rodger@afme.eu

FIA contacts:

Greg Wood, SVP, Global Industry Operations and Technology

+1 202 466 5460

gwood@fia.org

UK Finance contact:

Robert Driver, Principal, Capital Markets & Wholesale Policy

+44 (0)20 3934 1078

robert.driver@ukfinance.org.uk

Appendix – Examples of proposed amendments

“3.3 Prior to approval, the PRA expects, at a minimum:

(a) each algorithm, or business areas in which an algorithm is operated, to have assigned owners, who are accountable for the algorithm’s use and performance within that business. Such accountability includes ensuring that the algorithm is appropriately developed, implemented, used as intended and has undergone appropriate testing and deployment;

....

(c) all relevant parties as determined by the firm’s governance (e.g. Front Office, Risk Management, Other Systems and, or Controls functions) to have considered and to have signed-off on the risks (where relevant to a function) that the algorithm could expose the firm to. This ~~should~~ may also be assessed ~~under both normal, and severe but plausible conditions as part of periodic portfolio stress testing.~~”

“4.4 Any material variation of an algorithm (~~for example, regional variation based on firms’ internal definition of materiality~~) should be classified as a new algorithm and therefore subject to separate testing and approval. Minimum testing requirements should be clearly documented for all cases (new and variation of algorithms).”