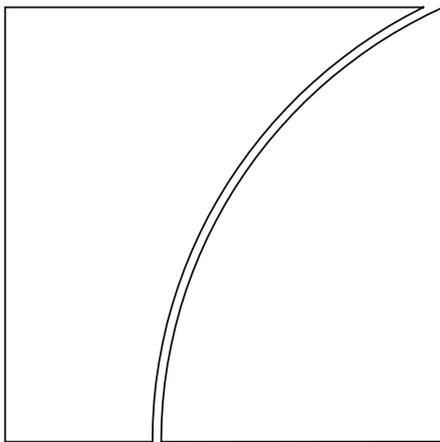


Committee on
Payments and Market
Infrastructures

Board of the International
Organization of Securities
Commissions

Consultative report

Resilience and recovery
of central counterparties
(CCPs): Further guidance
on the PFMI



August 2016



BANK FOR INTERNATIONAL SETTLEMENTS



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Executive summary

The purpose of this report is to seek comment on guidance for use by central counterparties (CCPs) on certain principles and key considerations in the CPMI-IOSCO *Principles for financial market infrastructures* (PFMI) relating to financial risk management for CCPs. This guidance is also intended for use by regulatory, supervisory and oversight authorities as they carry out their respective responsibilities for CCPs. The guidance that is being consulted upon in this report is not intended to create additional standards for CCPs beyond those set out in the PFMI, but rather aims to provide increased clarity and granularity on how the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) intend the PFMI to be implemented by CCPs. While numerous principles of the PFMI are referenced throughout the report, it should be noted that much of the guidance relates to governance (Principle 2), credit (Principle 4), margin (Principle 6), and liquidity (Principle 7).

CCPs have become increasingly critical components of the financial system in recent years, due in part to the introduction of mandatory central clearing for standardised over-the-counter (OTC) derivatives in some jurisdictions. It is imperative that each CCP is sufficiently resilient to withstand clearing member failures and other stress events to a very high probability. Furthermore, CCPs must have recovery plans that enable them to allocate credit losses and liquidity shortfalls fully and replenish financial and liquidity resources in a timely manner.

To improve the resilience of CCPs, this report provides guidance on five key aspects of a CCP's financial risk management framework: governance, stress testing for both credit and liquidity exposures, coverage, margin, and a CCP's contribution of its financial resources to losses. Further, the Committees issued guidance on recovery in October 2014 and this report reiterates several areas of that guidance on where CCPs need to further develop their recovery plans.

As strong governance is a necessary component of an effective financial risk management framework, Chapter 2 (governance) sets out the responsibilities of a CCP's board in its oversight of the risk management tools and requirements discussed in other sections of the report. Chapters 3 through 6 (credit and liquidity stress testing, coverage, margin, and a CCP's contribution to losses) build on this governance framework and seek to further explain how a CCP should design and implement these key aspects of risk management, adding specificity to certain principles and key considerations of the PFMI. Additionally, to address the remote possibility that risk management may prove insufficient in the most extreme market conditions, it is crucial that CCPs subject to the PFMI develop comprehensive recovery plans. Chapter 7 (recovery), therefore, restates several points from the prior CPMI-IOSCO guidance on recovery to assist CCPs in strengthening their recovery plans.

The guidance topics in this report are interrelated. The guidance in this report is intended to be applied holistically along with the requirements set out in the PFMI. Further, although the guidance that is being consulted upon does not create additional standards beyond those previously included in the PFMI, each CCP and the authorities responsible for its regulation, supervision and oversight should ensure that the following guidance is carefully considered.

1. Introduction

1.1.1. In 2009, the G20 Leaders committed themselves to ensuring that all standardised OTC derivatives contracts are cleared through CCPs.¹ Increased use of central clearing of derivatives is intended to enhance financial stability by simplifying the network of counterparty exposures between financial institutions and reducing the aggregate size of these exposures through multilateral netting by a CCP. The effectiveness of a CCP's governance arrangements and risk controls and the adequacy of its financial resources are critical to achieving these risk reduction benefits. Specifically, if CCPs are not properly managed, they can transmit financial shocks, such as liquidity dislocations and credit losses, across domestic and international financial markets.

1.1.2. In 2012, the CPMI and IOSCO (the Committees) published the PFMI, which significantly strengthened the international standards for risk management by FMIs.² These standards (principles) were designed to make financial market infrastructures (FMIs) more resilient to financial crises, and in particular, participant defaults. For example, the principles require that certain FMIs should maintain a level of financial resources to address credit, liquidity and general business risk higher than their pre-2012 level. In addition, the principles introduced a requirement for all FMIs to comprehensively manage risks and develop plans for recovery or orderly wind-down.

1.1.3. The PFMI outline 24 principles for FMIs and five responsibilities for authorities, and provide guidance on how each principle or responsibility can be implemented. With a few exceptions, the principles do not prescribe a specific tool or arrangement to achieve their requirements, instead allowing for different means to satisfy a particular principle. Where appropriate, some principles establish a minimum requirement to help contain risks and provide for a level playing field. The principles are designed to be applied holistically because of the significant interaction between principles; it is expected that the principles would be applied as a set and not on a standalone basis.

1.1.4. Since the publication of the PFMI, the Committees have been promoting full, timely and consistent adoption of the principles and responsibilities through their implementation monitoring programme. The Committees agreed to monitor implementation in 28 jurisdictions with authorities that are members of the Financial Stability Board (FSB), CPMI or IOSCO.³ To this end, the CPMI-IOSCO Steering Group⁴ established a standing working-level group, the Implementation Monitoring Standing Group (IMSG), to design, organise and carry out the implementation monitoring assessments.⁵ The monitoring work is being carried out at three levels: Level 1 assessments of the status of the implementation process

¹ In September 2009, the G20 Leaders agreed in Pittsburgh that: "All standardised OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest. OTC derivative contracts should be reported to trade repositories. Non-centrally cleared contracts should be subject to higher capital requirements. We ask the FSB and its relevant members to assess regularly implementation and whether it is sufficient to improve transparency in the derivatives markets, mitigate systemic risk, and protect against market abuse." Full statement available at: www.fsb.org/wp-content/uploads/g20_leaders_declaration_pittsburgh_2009.pdf.

² The *Principles for financial market infrastructures* are available on the CPMI and IOSCO websites: www.bis.org/cpmi/publ/d101a.pdf and www.iosco.org/library/pubdocs/pdf/IOSCOPD377-PFMI.pdf. In December 2012, CPMI-IOSCO published a disclosure framework and assessment methodology to promote consistent disclosures of information by FMIs and consistent assessments by international financial institutions and national authorities. This report is available on the CPMI and IOSCO websites at www.bis.org/cpmi/publ/d106.pdf and www.iosco.org/library/pubdocs/pdf/IOSCOPD396.pdf.

³ The 28 jurisdictions that are participating in the PFMI implementation monitoring exercise are Argentina, Australia, Belgium, Brazil, Canada, Chile, China, the European Union, France, Germany, Hong Kong SAR, India, Indonesia, Italy, Japan, Korea, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

⁴ The Steering Group comprises a subset of the members of the CPMI and the IOSCO Board, and is responsible for providing operational guidance on behalf of the parent committees on joint CPMI-IOSCO work.

⁵ The IMSG comprises representatives from 18 jurisdictions that reflect a balance of CPMI and IOSCO members and geographical dispersion, as well as a range of domestic and global FMIs' supervisors and overseers.

by each jurisdiction, Level 2 assessments of the completeness of a particular jurisdiction's framework and its consistency with the PFMI, and Level 3 assessments of the consistency in outcomes of such frameworks by considering practices of certain FMIs or authorities.⁶ The findings from these assessments inform the Committees on whether additional guidance is needed to facilitate implementation of the PFMI.

1.1.5. Given the increasing importance of CCPs in recent years, catalysed in part by the introduction of mandatory clearing in some jurisdictions, the G20 Finance Ministers and Central Bank Governors asked the FSB to work with the CPMI, IOSCO and the Basel Committee on Banking Supervision to develop and report back on a workplan for identifying and addressing any remaining gaps and potential financial stability risks relating to CCPs that are systemic across multiple jurisdictions and for helping to enhance their resolvability.⁷ The chairs of the relevant committees agreed on such a workplan (known as the "CCP workplan") in April 2015, and launched workstreams under their respective committees to address the substantive priorities related to CCP resilience, recovery planning, and resolvability.⁸

1.1.6. CPMI-IOSCO is the primary forum for the priorities identified under CCP resilience and recovery. Such work is carried out by another standing working-level group, the Policy Standing Group (PSG), established by the CPMI-IOSCO Steering Group. Consistent with the CCP workplan, on CCP resilience, the Committees evaluated the adequacy of several existing standards on loss absorption capacity (including coverage requirements), liquidity, and initial margin methodologies, taking into account the implementation of the PFMI, and CCP stress-testing practices. The Committees collected information on CCP recovery planning, including loss allocation tools and financial resources available to cover losses, including resources contributed by the CCP. In considering these findings, and those of the IMSG Level 3 assessment, the Committees concluded that certain standards in the PFMI would benefit from more-granular guidance in order to further advance implementation by CCPs and improve their overall resilience and recovery planning.

1.2 Purpose of the report

1.2.1. The purpose of this report is to provide guidance on the principles and key considerations in the PFMI regarding financial risk management for CCPs.⁹ The guidance is intended to provide further clarity and granularity on several key aspects of the PFMI to further improve CCP resilience: these are governance, credit and liquidity stress testing, margin, a CCP's contribution of its financial resources to losses, and coverage. The Committees issued guidance on recovery in October 2014.¹⁰ This report highlights several areas where CCPs need to further develop their recovery plans and restates relevant provisions from the existing guidance. The guidance in this report is not intended to create additional standards for CCPs beyond those set out in the PFMI, but rather to provide a more granular description of how the Committees expect the PFMI to be implemented by CCPs.

1.3 Key inputs into the report

1.3.1. There were four main inputs for this report: (i) two industry workshops conducted in March 2015 (on stress testing) and May 2015 (on the other areas of resilience and recovery) with participation by CCPs,

⁶ To date, four Level 1 assessments, four Level 2 assessments, one Level 3 principles assessment, and an assessment of the responsibilities of authorities have been carried out. All implementation monitoring reports are available on the CPMI and IOSCO websites at www.bis.org/cpmi/info_mios.htm?m=3|16|599 and www.iosco.org/publications/?subsection=public_reports.

⁷ See Communiqué from February 2015 G20 Finance Ministers and Central Bank Governors meeting at www.g20.utoronto.ca/2015/150210-finance.html.

⁸ See www.bis.org/cpmi/publ/d134b.pdf.

⁹ While the guidance included in this report is intended explicitly for use by CCPs, some of the guidance may be potentially relevant and useful to other types of FMIs.

¹⁰ See www.bis.org/cpmi/publ/d121.htm and www.iosco.org/library/pubdocs/pdf/IOSCOPD455.pdf.

direct participants, and indirect participants; (ii) the stocktake of current financial risk management and recovery practices in place at over 30 CCPs clearing securities and derivatives products in exchange-traded and OTC markets; (iii) papers submitted by industry groups; and (iv) the findings from the Committees' Level 3 assessment of financial risk management practices for a selected group of CCPs.

1.3.2. Soon after launching this work, the PSG invited a wide range of industry participants to participate in two workshops in order to better understand their respective views on CCP resilience and recovery. The first workshop, held in March 2015, focused entirely on stress testing, including a discussion of analytical frameworks for credit and liquidity stress testing and standardised stress testing. The second workshop, held in May 2015, covered a broader set of topics related to margin practices, governance, financial resources, coverage requirements, and recovery. Both events were well attended, with active participation by representatives from CCPs supporting both exchange-traded and OTC markets, direct participants (banks and broker-dealers), and indirect participants (asset managers). The participants were drawn from a number of jurisdictions across Asia, Europe and North America.

1.3.3. The PSG then conducted a broad stocktaking exercise in the summer of 2015 which covered six topic areas: (i) credit stress testing; (ii) liquidity stress testing; (iii) margin practices; (iv) prefunded loss absorption capacity (also referred to as coverage); (v) CCPs' contribution of financial resources to losses due to participant default and general business risk, including custody and investment risk; and (vi) recovery planning. While the Committees did not conduct a separate survey on governance practices, governance issues emerged as a common theme in the responses to the surveys as well as in the workshops.

1.3.4. The surveys were sent to CCPs that operate in the Committee members' jurisdictions, representing 17 different countries. Although completion of the surveys was voluntary, the Committees received responses from all CCPs invited to participate. The survey respondents represented a wide range of geographic locations, sizes, organisational structures, ownership structures and markets.

1.3.5. The PSG's work has also been informed by papers submitted by industry organisations on a range of issues. Specific contributors include the European Association of CCP Clearing Houses (EACH), the International Swaps and Derivatives Association, Inc. (ISDA), the Securities Industry and Financial Markets Association's Asset Management Group (SIFMA AMG), and The Clearing House Association (TCH). On behalf of their respective members, these groups presented views on CCP governance, transparency, stress testing, CCPs contributing their own financial resources to default losses, and recovery.¹¹

1.3.6. The [findings of the Level 3 assessment of CCP financial risk management](#) provided important input into this report regarding the consistency of outcomes arising from the implementation of the principles across 10 CCPs that participated in that exercise. The assessment noted where variations in outcomes may be due to challenges and interpretive issues that have emerged in implementing the principles. The Level 3 exercise found that, while these CCPs have made important and meaningful progress, there are a number of areas in which gaps and shortcomings have been identified in at least some CCPs' implementation measures, most notably in the area of recovery planning, where a majority of CCPs are still continuing to develop or enhance their recovery plans to be consistent with the principles and the guidance on recovery published in October 2014. Some gaps and shortcomings have also been identified in the areas of credit and liquidity management, including stress-testing practices.

¹¹ The papers submitted by EACH, ISDA, SIFMA AMG, and TCH are available on each organisation's website: EACH paper on "Best Practices for CCPs stress tests" (April 2015); ISDA letter to CPMI-IOSCO on CCP stress testing – transparency, governance, and best practices; SIFMA AMG letter to CPMI-IOSCO on recommendations on financial risk management of CCPs; and TCH letter to CPMI-IOSCO on recommendations on current CCP risk governance and member consultation processes.

1.4 Organisation of the report

1.4.1. This report is organised by topic area. Each topic begins with context followed by guidance on specific principles and key considerations in the PFMI. Where applicable, examples illustrate possible ways to implement the guidance. These examples are not meant to be prescriptive or exhaustive.

1.4.2. This report is organised in sections as follows: governance (Section 2), credit and liquidity stress testing (Section 3), coverage (Section 4), margin (Section 5), CCPs' contributions of financial resources to losses (Section 6), and recovery (Section 7).

1.5 Implementation

1.5.1. CCPs that are subject to the PFMI are expected to observe the principles on an ongoing basis.¹² In this regard, a number of gaps and shortcomings have been identified in at least some CCPs' implementation measures through the stocktaking exercise and through the Level 3 assessment.

1.5.2. In two areas in particular, the CCP and its supervisors, regulators, and overseers should consider these gaps and shortcomings to be serious issues of concern that warrant immediate action and that should be addressed with the highest priority. One area is recovery planning, where a number of CCPs have not yet put in place the full set of recovery rules and procedures as required under the PFMI. The other area is credit and liquidity risk coverage, where a number of CCPs have not yet put in place policies and procedures sufficient to ensure that they maintain the required level of financial resources on an ongoing basis. In addition, some CCPs do not include sufficient liquidity-specific scenarios in their stress-testing frameworks. CPMI-IOSCO expect to conduct targeted follow-up Level 3 reviews on CCPs' progress in these areas in the first half of 2017. This review will evaluate implementation measures in place as of 31 December 2016.

1.5.3. The guidance in this report is intended to support a CCP's level of observance of the PFMI by providing further clarity and granularity on several key aspects of CCP resilience and recovery. Although this guidance does not impose additional standards on CCPs or authorities beyond those in the PFMI, a CCP may need to make changes to its rules, procedures, governance arrangements, and risk management framework, and the relevant authority may need to make changes to its regulatory framework, in order to ensure that its practices are consistent with the guidance and thus that it fully observes the PFMI.

1.5.4. Accordingly, a CCP should promptly identify any areas where changes are necessary and develop a course of action to address them as expeditiously as practicable, taking into consideration the relevant timelines for any necessary regulatory approvals. The implementation of such changes should be completed no later than the end of 2017.

1.5.5. Relevant authorities should perform their own assessments of the CCP's observance with the PFMI and determine whether any further action by the CCP based on this guidance is needed¹³ and whether regulatory changes are required to ensure CCPs apply the principles and address any gaps.

¹² See paragraph 1.31 of the PFMI.

¹³ See paragraph 1.32 of the PFMI.

2. Governance

2.1 Context

2.1.1. Principle 2 of the PFMI sets forth governance requirements for a CCP. Specifically, the principle requires a CCP to have documented governance arrangements that provide clear and direct lines of responsibility and accountability and clearly specified roles and responsibilities for the CCP's board of directors (or equivalent) and the CCP's management.¹⁴ The principle also sets forth the explicit responsibility of a CCP's board of directors (or equivalent) to establish a clear, documented risk-management framework that includes the CCP's risk tolerance policy, and to ensure that the CCP's design, rules, overall strategy and major decisions reflect appropriately the legitimate interests of its direct and indirect participants and other relevant stakeholders.¹⁵ Accordingly, a CCP's board should have explicit responsibility to ensure that the CCP's margin system and stress-testing framework, as key elements of the CCP's overall risk management framework, are designed (i) to set and to maintain on an ongoing basis the required level of financial resources; (ii) to determine the amount of a CCP's own financial resources and the characteristics of those resources to absorb certain losses and (iii) to assess and limit the effects of procyclicality. The board should also have explicit responsibility for establishing a comprehensive disclosure and feedback mechanism for engaging with direct and indirect participants and other relevant stakeholders on the above areas of its risk management. In order for the board to ensure timely and appropriate action regarding the CCP's margin system and stress-testing framework, the board may delegate certain responsibilities to management. When doing so, the board should clearly define any delegated roles and responsibilities. This guidance is intended to provide further direction for the board in carrying out the responsibilities discussed in this section.

2.2 Guidance

Design and objectives of the margin system and stress-testing framework

2.2.1. The board of directors or equivalent should have the explicit responsibility of ensuring that the margin system and stress-testing framework are designed to set and maintain on an ongoing basis the CCP's required level of financial resources, which includes (i) the required level of total prefunded financial resources to cover credit exposures and (ii) the required level of qualified liquid resources in each currency to cover liquidity exposures. The required level of total prefunded financial resources (for credit exposures) and the required level of qualified liquid resources (for liquidity exposures) should be consistent with the CCP's risk tolerance and subject to the minimum coverage requirements for credit and liquidity risk, respectively, as set forth in the PFMI.¹⁶ In determining the risk tolerance of the CCP, including for setting the CCP's required level of financial resources above the minimum coverage requirements, the board should consider the CCP's risk profile (eg its membership composition, the instruments it clears, and the size and volatility of the markets it supports), as well as the stability of the broader financial system and other relevant public interest considerations.

2.2.2. As part of this responsibility, the board should consider and periodically review (i) how material changes to the CCP's products, services, policies or practices, and how changes to market conditions or structures, may affect its risk profile or risk tolerance, and (ii) how these changes should be incorporated into the CCP's risk management practices including, in particular, the CCP's margin system and stress-testing framework. If a CCP's risk profile is or becomes more complex, a more frequent review of the CCP's risk management practices by the board will be appropriate.

¹⁴ See Key Considerations 2 and 3 of Principle 2 of the PFMI.

¹⁵ See Key Considerations 6 and 7 of Principle 2 of the PFMI.

¹⁶ For the purposes of this report, risk tolerance is the aggregate level and types of risk that a firm is willing to accept in order to meet its strategic and business objectives, as defined by the board in the CCP's risk tolerance policy.

2.2.3. For the purpose of using stress testing to establish the required level of financial resources, the board should ensure that the stress-testing framework includes proper risk identification, scenario selection, risk measurement and appropriate analyses of stress-testing scenarios, models, and underlying parameters and assumptions. In this regard, the board has responsibility for ensuring that the criteria for and the selection of all relevant extreme but plausible scenarios and market conditions are clearly defined, justified and documented.

2.2.4. For the purposes of the design of the margin system, the board should have explicit responsibility for identifying, clarifying and evaluating the choices and trade-offs present in the design of the overall risk management framework, including the target degree of credit and liquidity risk mutualisation. As discussed in more detail in Section 5, part of this process entails evaluation of various models and approaches, and selection of those most appropriate for the product(s) cleared.

2.2.5. Notably, the board should be explicitly responsible for any material change to the margin system and stress-testing framework (eg changing margin models and changing the composition of total prefunded financial resources). In such cases, the board should properly consider, challenge and require senior management to explain the need for such a change, particularly where such changes are being driven by the CCP's evolving risk profile. For example, if a CCP's management recommends removing any historical event from the margin assumptions or stress-testing scenarios, then the board should require management to perform a comprehensive, rigorous and persuasive analysis. The board should provide an effective challenge to management's analysis, and the board should retain responsibility for any decision to remove any historical scenario based on a determination that the scenario is no longer plausible. Additionally, the board should ensure that any material change made to the margin system or stress-testing framework is documented and reported to the CCP's participants and other relevant stakeholders for review as part of the CCP's disclosure and feedback process as discussed in paragraphs 2.2.15 through 2.2.20.

Ongoing maintenance of required financial resources

2.2.6. The board should have explicit responsibility for ensuring that the CCP maintains the required levels of financial resources on an ongoing basis, and for ensuring that prompt corrective action is taken if the CCP is not, or is at material risk of not, doing so. The board should ensure that the CCP's policies and procedures clearly delineate the respective roles, responsibilities and authorities of management and the board for taking such action.

2.2.7. The board should be equipped with necessary information to make proactive decisions on resizing margin and the default fund to maintain the required levels of financial resources, and may delegate to management the authority to take prompt corrective action based on margin coverage and stress-testing results. For instance, the results of daily and, as relevant, intraday margin coverage analysis and stress testing should be reported to the chief risk officer (or other responsible individual) and relevant management committee daily and to the board at least monthly. Furthermore, the CCP's policies and procedures should clearly stipulate the thresholds, escalation criteria and breaches that should trigger an automatic and, where appropriate, same-day contribution from one or more direct participants. In addition, such policies and procedures should clearly articulate the form of the contribution (eg additional margin or default fund contributions), the method of calculating the contribution, and the relevant payment deadline.

2.2.8. The board should review the CCP's policies and procedures at least annually to ensure that they are effective in identifying and taking prompt action if the CCP is not, or is at material risk of not, maintaining its required financial resources, based on margin coverage and stress-testing results. The board also should immediately initiate a review of the CCP's risk management framework after a breach of either the required level of total prefunded financial resources to cover credit exposures, or the required level of qualified liquid resources in each currency to cover liquidity exposures.

Determining the amount and characteristics of a CCP's own financial resources to absorb losses

2.2.9. The board should have explicit responsibility for determining and exposing to certain losses an amount of its own financial resources that would enhance confidence in the CCP's risk management. In particular, the amount and characteristics (eg form, composition, segregation and seniority in a loss "waterfall") of a CCP's own contribution to absorb potential losses resulting from a participant default and the custody and investment of participant assets can enhance confidence that the CCP's risk-management design, rules, overall strategy and major decisions reflect appropriately the legitimate interests of its participants and other relevant stakeholders.¹⁷ When the board determines the amount and the characteristics of the CCP's own contribution, the board should employ mechanisms to seek and consider the views of direct and indirect participants and other relevant stakeholders. Such engagement should be designed to ensure that the board understands, accounts for and reflects stakeholder interests in the CCP's risk management. Moreover, exposing a CCP's owners to losses can provide appropriate incentives to owners to ensure that the CCP is properly risk-managed.¹⁸ However, without adequate governance arrangements and stakeholder engagement, these risk management incentives may be less effective.

2.2.10. The board should periodically review and approve the amount and characteristics of its own financial resources that the CCP exposes to losses. To support this process, the board should employ mechanisms to seek and consider the views of direct and indirect participants and other relevant stakeholders and, if necessary, to revise accordingly the amount and characteristics of its contribution. The CCP should also be transparent in its decision-making and clearly communicate the outcome of the review to its direct and indirect participants and other relevant stakeholders.¹⁹

Limiting destabilising, procyclical changes

2.2.11. The board should have explicit responsibility to assess and limit – to the extent practicable and prudent – destabilising, procyclical changes in the overall quantity of financial resources collected from direct participants, including initial margins, margin add-ons, default fund contributions and the impact of collateral haircuts. The approach established by the board for assessing and limiting procyclicality should be clearly defined, justified and documented with clear roles and responsibilities established for management and the board. In addition, the approach should be reviewed and approved by the board at least annually, supported by analysis performed by management and in consultation with participants, linked CCPs and other relevant stakeholders. For example, in the context of charges assessed under a CCP's margin system, default fund re-sizing or collateral haircut regime, a CCP could have in place policies and procedures that are designed to limit the probability of large, unpredictable charges.

2.2.12. As discussed in greater detail in Section 5, the board should establish quantitative and qualitative criteria that assist it in evaluating procyclical effects. For example, a CCP could use these criteria to assess whether changes in the overall quantity and composition of financial resources collected at the participant level, linked CCP and aggregate CCP level would have a destabilising, procyclical impact. Such criteria could also be used to assist the CCP in conducting periodic assessments of observed destabilising, procyclical changes, and the results could then be reported to the chief risk officer, the relevant management committee, and the board.

2.2.13. The board should also ensure that the CCP conducts regular and rigorous due diligence of its participants' understanding of, and their ability to predict and manage, potential changes in margin,

¹⁷ Prefunded financial resources used to cover losses are commonly referred to as a "waterfall" and may include the defaulter's initial margin, the defaulter's contribution to a prefunded default arrangement, a specified portion of the CCP's own funds and other participants' contributions to a prefunded default arrangement. See paragraph 3.4.17 of the PFMI. In addition, in the case of some CCPs for cash markets, the CCP may require each participant to provide collateral to cover credit exposures; they may call these requirements margin, or they may hold this collateral in a pool known as a clearing fund. See paragraph 3.6.2 of the PFMI.

¹⁸ See paragraph 3.3.9 of the CPMI-IOSCO report on *Recovery of financial market infrastructures*.

¹⁹ See Key Consideration 7 of Principle 2 and paragraph 3.4.24 of the PFMI.

default fund and collateral haircuts in times of market stress. This due diligence helps ensure that participants understand and have taken the necessary steps to be prepared to meet such requirements while the CCP also looks to implement and maintain its framework for addressing procyclicality.

Review and validation of margin system and stress-testing framework

2.2.14. The board should have explicit responsibility for ensuring that the validation of the CCP's margin system and stress-testing framework for both credit and liquidity risks is conducted at least annually and in a manner that is independent of the development, implementation and operation of the models and their methodologies. In addition, the board should also have explicit responsibility for ensuring that the validation process is subjected to an independent review of its adequacy and effectiveness.²⁰ This responsibility, in turn, requires the board to be informed of the results of all such validations and reviews as well as to approve the CCP's response to their findings. Any advice provided by the CCP's risk committee on such validations and reviews should be provided to and considered by the board. For example, any validations and reviews of the margin system and stress-testing framework (eg methodology, parameters, assumptions, changes, and improvements) could be provided to the CCP's risk committee (whose membership typically includes representatives of direct participants and often also indirect participants). The risk committee, as in other instances, could then discuss these validations and reviews for presentation to and final endorsement by the board.

Disclosure and feedback mechanism for reviewing the margin system and stress-testing framework

2.2.15. The board of directors should have explicit responsibility for establishing a comprehensive disclosure and feedback mechanism for soliciting views from direct participants, indirect participants and other relevant stakeholders to inform the board's decision-making regarding the CCP's margin system, the stress-testing methodology and stress-testing results.²¹ Instituting a feedback mechanism ensures that the board is informed of, and considers for the purposes of internal review, any concerns expressed by such parties with respect to the CCP's risk management framework, including the margin system and stress-testing framework. To achieve these results, the board should ensure that the mechanism employed is properly implemented and carried out on an ongoing basis. In establishing such a mechanism, the board should specifically contemplate a predetermined frequency of its communication with direct participants and any other relevant stakeholders. In addition, the mechanism should be designed to enable the CCP to draw upon the relevant expertise and perspectives of all relevant stakeholders.

2.2.16. In order to solicit useful feedback on its margin system and stress-testing framework, a CCP will need to disclose information to participants and any other relevant stakeholders to facilitate their review. A CCP should disclose information in such a way that does not reveal the positions of individual participants, direct or indirect, or may put the safety and soundness of the CCP at risk. The information disclosed should be at a level of detail sufficient to enable stakeholders to understand and effectively provide feedback concerning the rigour of the CCP's approach, methodologies, parameters, assumptions and scenarios.

2.2.17. An effective disclosure and feedback mechanism for reviewing the CCP's margin system and stress-testing framework should include:

- i. Information regarding margin coverage and stress testing for both credit and liquidity risks, including methodologies, parameters, assumptions (eg market liquidity and closeout costs implicit in its assumed margin period of risk (MPOR) and closeout periods), all scenarios as well

²⁰ See also paragraph 3.2.16 of the PFMI.

²¹ Other relevant stakeholders may include but are not limited to other CCPs, central securities depositories, securities settlement systems and payment systems.

as the results of stress testing and margin coverage tests, along with relevant sensitivity analyses and reverse stress-testing results.

- ii. Information regarding the CCP's approach to assessing and limiting destabilising, procyclical changes of all financial resources collected.
- iii. Categories of recipients, including the related level of detail and frequency of disclosures to such recipients. The level of detail and frequency of such disclosure would vary depending on the type of stakeholder.
- iv. Identification of the disclosure methods appropriate for each category of recipient.
- v. The implementation of controls to ensure that disclosure is consistent over time.
- vi. The identification of explicit and effective channels for receiving and considering feedback from relevant stakeholders as part of the board's decision-making process relating to reviewing the CCP's margin system and stress-testing framework; and processes for addressing, explaining and documenting actions taken in response to stakeholder feedback, including cases in which such action is not taken.

2.2.18. For the purposes of implementing an effective feedback mechanism, feedback could be reported to the CCP's risk management function; the risk committee, which typically includes representatives of direct participants; and the board. Other channels for feedback include (i) including direct or indirect participant representatives on the CCP's risk committee (where the duties of such representatives are to the participant they represent); (ii) industry forums; (iii) consulting trade groups when major changes to the CCP are planned; and (iv) public comment periods for proposed changes to a CCP's rules, procedures or operations. Records should be kept when participants and other relevant stakeholders are consulted, no matter what the forum.

2.2.19. In implementing this disclosure and feedback mechanism, a CCP should consider providing certain information to participants and other relevant stakeholders, with the appropriate level of detail, frequency and safeguards, as noted above. The CCP should make available such information in a consistent manner and over a secure channel that facilitates timely access. This can be achieved, for example, through a secure connectivity between a member and a CCP or through direct engagement of the chief risk officer of the member institution during due diligence processes.

2.2.20. In addition, on an annual basis, the CCP should inform relevant authorities of its board's review and approval of the validation of the margin system and stress-testing framework, including any recommendations from its risk committee. A CCP should provide relevant authorities with information regarding the review and validation process. For example, this could include (i) the CCP's margin system and stress-testing methodology, assumptions, scenarios and test results; (ii) annual review and independent validation of the margin system and stress-testing methodology; and (iii) records of discussions on the annual assessment of extreme but plausible market conditions by the CCP's risk committee, and approvals by the board. The level of detail of such information and its frequency can vary depending on the statutory or other legal responsibilities of the authorities.

3. Stress testing

3.1 Context

3.1.1. Stress testing is fundamental to the risk management framework for a CCP. Credit and liquidity stress tests help the CCP determine whether it is maintaining sufficient prefunded financial resources pursuant to Key Consideration 4 of Principle 4 and Key Consideration 4 of Principle 7.²² Furthermore, as described in Section 6, the results of these stress tests inform the CCP, including the board, when it is deciding whether additional prefunded financial resources should be maintained beyond the minimum requirements in the PFMI. The PFMI also sets certain expectations for the scope and frequency of credit and liquidity stress testing by a CCP.

3.1.2. For credit stress tests, Key Consideration 5 of Principle 4 calls for a CCP to “determine the amount and regularly test the sufficiency of its total financial resources available ... through rigorous stress testing,” while Key Consideration 6 of Principle 4 notes that: “In conducting [credit risk] stress testing, a CCP should consider the effect of a wide range of relevant stress scenarios in terms of both defaulters’ positions and possible price changes in liquidation periods. Scenarios should include relevant peak historic price volatilities, shifts in other market factors such as price determinants and yield curves, multiple defaults over various time horizons, simultaneous pressures in funding and asset markets, and a spectrum of forward-looking stress scenarios in a variety of extreme but plausible market conditions.”

3.1.3. liquidity stress tests, Key Consideration 9 of Principle 7 establishes an expectation for a CCP to conduct such tests, recognising that stress scenarios should encompass the characteristics listed above for credit stress tests and “should also take into account the design and operation of the FMI, include all entities that might pose material liquidity risks to the FMI (such as settlement banks, nostro agents, custodian banks, liquidity providers, and linked FMIs), and where appropriate, cover a multiday period”.

3.1.4. The challenges of stress testing are identifying the credit and liquidity risks to which a CCP could be exposed, constructing a range of stress scenarios that adequately capture potential future extreme but plausible market conditions, and using these scenarios to derive suitable measures of the CCP’s aggregate credit and liquidity exposures and resources available to absorb these exposures, and evaluating the adequacy of its financial and liquid resources. It is also important for a CCP to regularly perform additional analysis that looks beyond the results of its daily stress tests. Accordingly, this section sets out guidance with respect to stress testing on: the structure of credit and liquidity stress-testing frameworks; the identification of risks; the development of extreme but plausible scenarios; and the calculation and aggregation of stress test results. Additional guidance is provided on a CCP’s analysis of stress-testing scenarios, models, and underlying parameters and assumption.

3.1.5. The guidance below is intended to set clear expectations for the rigour of the credit and liquidity stress tests called for in the PFMI, as appropriate to the systemic importance of CCPs.

²² Specifically, Principle 4, Key Consideration 4 states that a CCP should “maintain ... financial resources to cover a wide range of potential stress scenarios that should include ... the default of the [one or two participants, including their affiliates] that would potentially cause the largest aggregate credit exposure for the CCP in extreme but plausible market conditions”. Similarly, Principle 7, Key Consideration 4 explains that a CCP should “maintain sufficient liquid resources in all relevant currencies to ... meet ... payment obligations on time with a high degree of confidence under a wide range of potential stress scenarios that should include ... the default of the participant and its affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions”.

3.2 Guidance

Structure of credit and liquidity stress-testing frameworks

3.2.1. Principles 4 and 7 of the PFMI establish similar, but subtly distinct, requirements on how a CCP should conduct credit and liquidity stress tests for the purposes of verifying the adequacy of financial resources. In particular, Principle 7 of the PFMI establishes a requirement for a CCP to capture in liquidity stress tests exposures to entities other than its participants.²³

3.2.2. A CCP should conduct distinct but consistent stress tests for credit risk and liquidity risk. A CCP's role as a central counterparty creates both credit and liquidity exposures, which must be covered by prefunded available financial resources and qualifying liquid resources, respectively. In conducting credit and liquidity stress testing, CCPs need to ensure that these exposures are adequately covered, taking into account the likely value of these resources in stressed market conditions.

3.2.3. It will often be the case that there is some overlap between credit and liquidity stress-testing scenarios, for example in the way in which potential changes in the value of cleared positions (and resulting variation margin payments) are incorporated into the tests. However, a counterparty default can create a liquidity exposure in excess of, or even in the absence of, any credit exposure, as the CCP may be required to convert non-cash collateral or alternative currencies into the currency required to meet its payment obligations when due.²⁴

3.2.4. Accordingly, a CCP should also develop scenarios that address other potential sources of liquidity risk, such as the failure of a liquidity provider, settlement bank, nostro agent or investment counterparty.

3.2.5. A CCP should ensure that its credit and liquidity stress tests are structured in a way that is consistent with the rules and procedures that govern, respectively, how credit and liquidity risk is managed day to day and following a participant default. This may include performing credit and liquidity stress tests over different horizons, recognising the importance of intraday liquidity in particular.

3.2.6. In addition, some CCPs operate multiple clearing services, each clearing a distinct set of (usually related) products.²⁵ Some of these CCPs manage their credit risk by maintaining separate default waterfalls to support each distinct service such that losses incurred in one service line cannot be covered by resources maintained to support another service line. A CCP employing this structure should conduct separate credit risk stress tests for each clearing service and the corresponding default waterfall. Similarly, if a CCP manages its liquidity risk on a service line basis, it should conduct separate liquidity stress tests for each clearing service and corresponding default waterfall. For other CCPs, a portion of credit or liquidity resources (eg excess credit or liquidity resources above the required minimum amounts) may be shared, and in still other cases, all credit or liquidity resources may be shared. A CCP should structure its credit and liquidity stress tests accordingly for each service line and for all relevant combinations, consistent with its particular arrangements. In the latter cases, the CCP should be attentive to the challenges associated with modelling stress scenarios that span multiple asset classes.

3.2.7. Even where credit and liquidity exposures derive from the same external event, a CCP may require additional liquid resources or arrangements to the extent that the prefunded financial resources available to meet the credit exposure are not sufficiently liquid. For example, a CCP may require a prearranged and

²³ See Key Consideration 9 of Principle 7 of the PFMI.

²⁴ A CCP's credit exposure in the event of a participant default is the net adverse movement in the value of the defaulter's portfolio over the period the CCP holds the position (ie until the position is closed out). However, during that period the CCP will need sufficient cash in the requisite currency to fund payment and settlement obligations as they fall due, and differences in the timing may mean that the CCP's liquidity exposure is larger than its credit exposure. This is especially the case for cash CCPs, which may face relatively modest net credit exposures but may need to fulfil a significant amount of gross settlement obligations over the liquidation period.

²⁵ Although precise structures vary, in general a clearing service is characterised by a common set of rules and related arrangements to mutualise losses (in excess of margin) across participants in the service.

highly reliable funding arrangement for the highly marketable collateral it uses to cover credit risk to qualify as liquid resources.

3.2.8. Similarly, since a CCP may have obligations to make payments in a range of currencies, it must maintain sufficient liquid resources in each currency for which it has an obligation. Again, this may result in a situation in which the CCP requires additional arrangements to convert promptly available prefunded financial resources in one currency into the required currency (ie the currency in which the CCP has the obligation).

3.2.9. Risks from entities other than participants can also affect the size of, or timeliness of access to, a CCP's resources. A CCP should recognise other potential sources of liquidity risk – arising for example from the failure of a liquidity provider, settlement bank, nostro agent or investment counterparty – and ensure its sources of risk are properly captured in bespoke liquidity stress tests.

Identification of risks

3.2.10. As set forth in Key Consideration 1 of Principle 3, a CCP should “have risk-management policies, procedures, and systems that enable it to identify, measure, monitor, and manage the range of risks that arise in or are borne by the FMI”. Key Consideration 2 of Principle 4 provides that the CCP “should identify sources of credit risk”, and Key Consideration 1 of Principle 4 notes that credit exposures and risks may arise to and from participants, payment, clearing, and settlement processes, and that these exposures may arise from “current exposures, future exposures, or both”. Similarly, Key Consideration 1 of Principle 7 states that a CCP should “have a robust framework to manage its liquidity risks from its participants, settlement banks, nostro agents, custodian banks, liquidity providers, and other entities”. The guidance below is intended to cover the full range of risks, both credit and liquidity, that should be captured in stress testing.

Identification of all sources of credit risk

3.2.11. A CCP should identify all the sources of credit risk to which it could be exposed in extreme but plausible market conditions and ensure that each source of risk is appropriately captured in credit stress tests. These risk sources should include exposures related to the market value of cleared positions as well as the market value of the collateral and any other financial resources available to cover these exposures. Certain risks could affect both exposures and resources, and a CCP should ensure that it accounts for these risks consistently and accurately. A CCP should also identify credit exposures on both an end-of-day and intraday basis, recognising the potential for the composition of participants' positions and the collateral they provide to vary materially during the business day.

Risks related to credit exposures

3.2.12. A CCP should identify all the sources of risk that affect the market value of cleared portfolios. These risk sources should include, as appropriate, price movements²⁶ for all cleared products as well as potential changes in the size and composition of cleared portfolios over the liquidation period. Transaction costs or bid/offer spreads²⁷ associated with liquidating or hedging the portfolio of cleared products in extreme but plausible market conditions should also be considered. A CCP should also consider potential wrong-way risks arising, for example, from correlation between the market value of cleared products and the creditworthiness of participants. Additional risk sources may include foreign exchange risk, risks associated with linked FMIs, and risks posed by both end-of-day and intraday settlement processes (including the relevant standard settlement cycle generally), recognising in particular the impact on the

²⁶ A CCP should consider stressing intraday measurements as well as those taken at the end-of-day, if intraday exposures tend to be larger because of specific features of the applicable markets and settlement processes or specific observable or historical events.

²⁷ These costs may be higher for concentrated positions or large portfolios.

composition – and therefore the market value – of cleared portfolios.

3.2.13. For the purposes of conducting credit stress tests, a CCP should ensure that all identified sources of risk are appropriately captured in a discrete set of measurable risk factors that form the basis of stress scenarios. Some risk sources are directly observable by the CCP, while other risk factors will need to be estimated or modelled by the CCP, including for example potential future changes in market prices (in extreme but plausible market conditions) and other non-observable, portfolio-specific risks such as wrong-way risk, jump-to-default risk, or stressed bid/ask spreads or other transaction costs.

Risks related to credit resources (ie financial resources)

3.2.14. A CCP should identify all sources of risk related to collateral and other financial resources held to cover credit exposures. Sources of risk that affect CCP credit resources include risks that affect the value of resources (eg market value of collateral) or access to those resources (eg performance of a custodian). A CCP should also consider the interaction between exposures and resources by incorporating a specific assessment of wrong-way risks in determining potential losses, including the effect on collateral held by the CCP. The sources of risk considered by a CCP should include changes in collateral and investment values that may be experienced during extreme but plausible market conditions as well as potential credit losses arising from the default of a custodian used by the CCP.²⁸

Identification of all liquidity risks

3.2.15. A CCP should identify, by currency, all sources of liquidity risk to which it could be exposed in extreme but plausible market conditions, recognising that liquidity exposures can arise even in the absence of a participant default or when there is no uncovered credit exposure. Sources of risk include the failure of participants (or their nostro agents) to settle payment obligations on time and in the required currency, such as payment obligations associated with variation margin calls or the delivery of securities, foreign exchange or physical assets. Sources of liquidity risk also include risks that affect the value of liquidity resources (eg collateral value) or the ability of the CCP promptly to access those resources (eg due to non-performance of a custodian, settlement agent, or credit provider).

3.2.16. A CCP should also identify liquidity risks, by currency, on both an end-of-day and intraday basis, at every point during the assumed liquidation period where a payment may be necessary, taking account of, for instance, intraday price movements, changes in intraday participant positions, and intraday settlement processes that are used within and across a CCP's service lines, if applicable. Similarly, a CCP should also consider other relevant sources of liquidity risk such as collateral-related defaults, foreign exchange risks, and intraday settlement processes that may involve or depend upon other relevant entities such as settlement banks, nostro agents, custodian banks, liquidity providers and linked FMIs.

Risks related to liquidity exposures

3.2.17. A CCP should identify all sources of risk related to its liquidity exposures. These sources of liquidity exposures should include risks related to cleared positions and risks related to the default management process to close out these exposures. At a minimum, a CCP should consider risks that will impact the amount of liquidity resources needed to meet all relevant payment outflows, such as variation margin, payment obligations related to settlement obligations, or payments related to derivatives expirations, on time and in the required currency. For example, these risks could include the following: liquidity needed to satisfy variation and other margin payment obligations arising from the defaulter's

²⁸ A CCP should consider stressing intraday measurements as well as those taken at the end-of-day, if intraday exposures tend to be larger because of specific features of the applicable markets and settlement processes or specific observable or historical events.

portfolio;²⁹ transaction costs or bid/offer spreads associated with liquidating or hedging the portfolio of cleared products in extreme but plausible market conditions;³⁰ liquidity needed to satisfy payment obligations including, but not limited to, settlement payments, coupon payments, option premium payments, and payments relating to derivatives expiries or physical deliveries; liquidity needed to satisfy margin payment obligations to non-defaulting participants arising from their reducing the risk in their portfolio of positions or withdrawal of excess collateral; increase in the size of obligations due to specific wrong-way risk and, to the extent appropriate, general wrong-way risk; foreign exchange risks in all currencies; and risks associated with linked FMIs. A CCP should identify wrong-way risk and transaction costs in the construction of its liquidity stress tests.

3.2.18. The size of some liquidity risks is known with certainty by the CCP (eg pre-scheduled settlement obligations during the liquidation period), while the size of other risks will need to be modelled by the CCP (eg future variation margin payments).

Risks related to liquidity resources

3.2.19. A CCP should identify risks related to the ability promptly to access its liquidity resources. The effects of the failure of certain service providers to the CCP (such as a settlement bank, securities settlement system, or custodian) may prevent a CCP from accessing its liquidity resources in a stressed market and should be considered as sources of risk. Risks related to the performance of a liquidity provider (including the default of participants that act as liquidity providers) can also affect the ability of the CCP to quickly convert collateral into the required amount of cash in the appropriate currency to meet its payment obligations when due.

3.2.20. Other risks related to liquidity resources could include the following: (i) changes in collateral and investment values (either in terms of their liquidation value or their haircut value when accessing collateralised liquidity from a liquidity provider) that may be experienced either on an intraday or end-of-day basis during extreme but plausible market conditions (particularly if the collateral or investments are concentrated);³¹ (ii) inability to access committed liquidity facilities, such as repo arrangements, lines of credit, or foreign exchange swaps, due to either the default of a liquidity or service provider or because of a market disruption; (iii) inability to access uncommitted liquidity resources, including market transactions, due to a market disruption or because of a lack of credit to the CCP;³² (iv) the default of an issuer of collateral held by the CCP or a direct participant that is also a liquidity or service provider; and (v) failure of or delay in operations of a settlement bank, custodian, securities settlement systems, or payment system. In identifying these sources of risk, the CCP should also consider the interaction between exposures and resources by incorporating a specific assessment of wrong-way risks in determining potential losses, including the effect on collateral used to access liquidity facilities.

3.2.21. As a part of its consideration of liquidity risks, a CCP should identify events that could affect the CCP's ability to make intraday payments, if applicable, in the appropriate form (eg domestic currency, foreign currency, or securities) when due, such as events that impede the CCP's ability to convert non-cash resources to cash.

²⁹ The modelling of liquidity outflows that relate to market risk should be consistent with the stress scenarios developed for credit stress testing.

³⁰ These costs may be higher for concentrated positions or large portfolios.

³¹ A CCP should consider stressing intraday measurements as well as those taken at the end of the day, if intraday exposures tend to be larger because of specific features of the applicable markets and settlement processes or specific observable or historical events.

³² This guidance is independent of the definition of qualifying liquid resources elaborated in Principle 7, Key Consideration 5, ie a CCP should always cover its minimum liquid resource requirement with a combination of cash and prearranged and highly reliable arrangements for converting highly marketable collateral into cash (in the appropriate currency).

Development of extreme but plausible scenarios

3.2.22. Stress testing is designed to evaluate the credit and liquidity exposures a CCP could face in extreme but plausible market conditions. Constructing effective scenarios for stress testing involves designing scenarios that are sufficiently extreme to rigorously stress all identified sources of credit and liquidity risk, while retaining a level of plausibility that supports using the results for risk management. Establishing the plausibility or implausibility of a scenario often involves subjective judgment by the CCP, and such judgment benefits from extensive expertise with respect to the behaviour, the ecosystem of the markets cleared, and the risk tolerance of the CCP as discussed in paragraph 2.2.1.

3.2.23. It should be recognised that references to “extreme but plausible market conditions” are in the context of a participant default. Such a default, particularly for a large participant, may itself have second-order effects that amplify the stress while the CCP is closing out the defaulters’ positions. Therefore the determinations of which market conditions are extreme but plausible should be conditional on the default of the participant (or two participants) and their affiliates that would result in the largest aggregate credit and liquidity exposures, respectively. Indeed, where a CCP is modelling the default of two participants and their affiliates, the feedback effects from the default of the first participant are likely to amplify the extreme but plausible market conditions in which the second participant is assumed to default.

3.2.24. When constructing an appropriate set of scenarios, a CCP will also confront the difficulty that different positions or portfolios may have very different exposures to different movements in risk factors. A further challenge is the possibility that similarly sized losses could be produced by different movements in risk factors for a single portfolio. Ultimately, the scenarios used in stress testing must be evaluated to determine whether they are, when considered collectively, comprehensive enough to reliably determine the exposures in cleared portfolios under any of the range of extreme market developments that might plausibly develop.

3.2.25. One of the most direct ways to start to derive a set of extreme but plausible market conditions is to use historical scenarios. In order to generate sufficiently extreme tests, the PFMI expect a CCP to include peak historical price volatilities.³³ Because different portfolios are exposed to underlying risk factors differently, the relevant peak historical volatility might differ for different portfolios and therefore the use of multiple historical stress scenarios will be required. Nevertheless, because of challenges such as the limited frequency of extreme but plausible market conditions or limited historical data, historical stress scenarios alone are not sufficient. Moreover, extreme but plausible market conditions that a CCP could face in the future may not be captured in historical data.

3.2.26. Given the limitations of a purely historical approach, the PFMI, as discussed above in Section 3.1, call for the use of other techniques based on a forward-looking approach to derive stress scenarios, including hypothetical and theoretical methodologies (combinations of the methodologies are also encountered in practice). In particular, the theoretical approach uses primarily statistical modelling to derive the extreme but plausible scenarios using proxy data or by extrapolating historical data that do not contain sufficiently severe periods of market stress to observe directly extreme but plausible market conditions. In a complementary fashion, the hypothetical approach (sometimes referred to as narrative or prospective) focuses on situations in which the stress event would not be captured by historical or theoretically based stress events. Deriving these scenarios involves both subjective judgment and imagination. Moreover, as discussed further below, it is important that these are exercised by persons with expert knowledge of the particular markets involved, including the factors that might drive extreme price changes in those markets.

Comprehensiveness of scenarios

3.2.27. A CCP should model extreme but plausible market conditions in a manner that adequately captures all the risks identified in paragraphs 3.2.10 through 3.2.21, using a mixture of historical and

³³ See Key Consideration 6 of Principle 4 of the PFMI.

forward-looking scenarios. Scenario construction should also take into account the possibility that the failure of one or more participants will precipitate or exacerbate market volatility and recognise that exposures may be larger intraday than at the end of the day. In addition, for liquidity risk, a CCP should use forward-looking scenarios in its estimate of liquidity resources as well as in its estimate of liquidity needs (ie liquidity resources also need to be stressed).

3.2.28. The modelling framework needs to incorporate a set of risk factors that is flexible but sufficiently comprehensive to capture, under a wide range of extreme but plausible market conditions, both the material risks that currently impact cleared portfolios and risks that could plausibly emerge in future. The set of risk factors used in constructing historical and forward-looking scenarios for credit and liquidity stress testing should be justified using a combination of expert judgment and reliable statistical techniques that allow a CCP to identify – on an ongoing basis – the risk factors to which it is most exposed,³⁴ recognising in particular that different portfolios will be exposed to different risk factors. For example, while some directional portfolios (eg portfolios that are primarily exposed to an increase or decrease in the price of one product or related group of products) will be exposed mainly to outright price movements, other portfolios may reflect trading strategies that entail exposure to basis or curve risks, eg long and short positions at different points on a forward or yield curve which may be more sensitive to correlation shifts rather than general price movements. A CCP should ensure, as appropriate, that its stress scenarios adequately reflect the trading strategies employed by its direct and indirect participants.

3.2.29. The resulting set of extreme but plausible scenarios should be diverse enough to thoroughly stress all cleared current, historical, and hypothetical portfolios (and other exposures where relevant).³⁵ Moreover, stress scenarios should cover comprehensively both credit and liquidity risks. The extreme but plausible scenarios used for liquidity stress testing should, in the aggregate, include all the scenarios used for credit stress testing and should also include bespoke scenarios that affect the CCP's liquidity exposures but not its credit exposures, or affect the size of its liquidity resources but not its financial resources.

Development of scenarios using historical data

3.2.30. A CCP should construct stress scenarios that are comprehensive, including potential effects on market liquidity and hedging costs, and that take into account a wide variety of stressed market conditions. The PFMI expects a CCP to include relevant peak historic price volatilities in its scenarios,³⁶ and to ensure its scenarios are appropriate for determining the CCP's required level of default protection in the light of current and evolving market conditions.³⁷

3.2.31. A CCP should consider the availability of reliable data and should maintain and implement procedures to verify the historical data set, including checks for erroneous data and missing values.³⁸ A CCP should regularly test and validate the methods used to verify data accuracy and select the risk factors used to construct stress scenarios.

3.2.32. In developing historical stress scenarios, a CCP should replicate as closely as possible historical stress events for which reliable price data are available. A CCP should include all of the most extreme scenarios observed unless the CCP determines, based on clear and convincing analytical evidence that a historical level of market volatility cannot reoccur. Historical stress scenarios should not be excluded purely on account of the passage of time. Decisions about the exclusion of observed historical scenarios on the basis that reoccurrence is implausible should be explicit and subject to a strong governance process. The

³⁴ For example, using Principal Component Analysis (PCA) or similar dimension-reduction techniques.

³⁵ When designing hypothetical scenarios, a CCP should consider how the participants' positions may change as a result of the particular stress event, for example by considering plausible day-over-day changes in exposures.

³⁶ See Key Consideration 6 of Principle 4 and Key Consideration 9 of Principle 7 of the PFMI.

³⁷ See Key Consideration 5 of Principle 4 of the PFMI.

³⁸ This guidance would also be applicable to historical data used as the basis for constructing forward-looking scenarios.

procedures used for this analysis and any adjustments must be rigorously tested and validated at regular intervals, including in response to market developments, and subject to a strong and detailed governance process. Where necessary, historical scenarios may need to be adjusted to ensure plausibility, for example by using relative rather than absolute price moves when asset prices are low.³⁹ This can be done in a variety of ways, but should preserve the intention that historical stress events are replicated as accurately as possible.

3.2.33. If the reliable historical data available are too limited to ensure that the observed scenarios are sufficiently extreme, for example for a new product or an illiquid product with limited historical data, a CCP should use robust statistical methods to construct extreme but plausible scenarios that are subject to regular validation. There are a wide range of methods that could be used for this purpose. For example, a CCP could use proxies from similar asset classes to synthetically extend the historical data that are available, based on an analysis of the relationships between data from the new asset class and data from related asset classes with a longer history. Alternatively, a CCP could simulate stressed market events based on available historical data and using statistical tools such as extreme value theory.⁴⁰ Where statistical models are used to develop stress scenarios, a CCP should calibrate these models to the risk tolerance of the CCP and ensure that they are subject to regular validation and testing, especially as market conditions change.

Use of end-of-day, intraday, and intra-period price and intraday position movements

3.2.34. Key Consideration 6 of Principle 4 provides that a CCP “should consider the effect of a wide range of relevant stress scenarios in terms of both defaulter’s positions and possible price changes in liquidation periods”.⁴¹ A CCP should consider the effects of how positions may change on an intraday basis; in doing so it should consider the effects of historical and forward-looking stress scenarios that are based on relevant stressed intraday position changes after the last collection of prefunded financial resources. Relevant scenarios should be incorporated into a CCP’s stress-testing framework of the sufficiency of prefunded financial resources. For example, a CCP should consider developments in the size, composition, and directionality of participants’ positions during the day.

3.2.35. A CCP should consider incorporating historical and forward-looking stress scenarios that are based on peak intraday and intra-period price moves, in addition to stress scenarios using end-of-day changes.⁴² For example, the CCP should consider scenarios using historical maximum price changes, including on an intraday basis, between any two points during the stressed period of risk (ie peak to trough price moves). In addition, the CCP should consider incorporating potential intraday price changes, as appropriate, including those that are larger than end-of-day price changes and adapt historical stress scenarios accordingly. For example, in order to capture the most extreme price movements in its historical stress scenario based on the stock market crash of 1987, a CCP could consider using both end-of-day and intraday peak to trough equity and interest rate price changes capture extreme movements on and during October 19th and 20th.

³⁹ Other “filtering” methods (eg using shifted log returns) may also be used for this purpose, but should be subject to regular validation and testing wherever a modelling assumption is used.

⁴⁰ Extreme value theory is a statistical approach to modelling the distribution of extreme events, which by their nature are rare and indeed may never have been observed. Extreme value theory relies on the fact that many distributions have similar structures in the extremes or tails: for example, “fat-tailed” distributions used in finance feature such similarity. Methods based on the theory project from observed data to more extreme events, in a statistically defensible way.

⁴¹ See Key Consideration 6 of Principle 4 and also Key Consideration 9 of Principle 7 (directing a CCP to consider “a wide range of relevant scenarios”) of the PFMI.

⁴² As discussed previously, these costs may be higher for concentrated positions or large portfolios.

Development of forward-looking scenarios

3.2.36. In order to implement a suite of comprehensive scenarios that reflect the risks in different portfolios, a CCP should complement historical scenarios with forward-looking scenarios. A CCP should use forward-looking scenarios for both credit and liquidity risk, and should draw on internal and external market expertise to anticipate as far as practicable future instances of extreme but plausible market conditions. The PFMI state that a CCP should “consider the effect of a wide range of relevant stress scenarios...includ[ing] relevant peak historic price volatilities ... and a spectrum of forward-looking stress scenarios in a variety of extreme but plausible market conditions”. Accordingly, in addition to stress scenarios based on historical data,⁴³ the CCP should conduct stress tests based on a full spectrum of forward-looking scenarios constructed using hypothetical methods. These scenarios should aim to capture stress events that are plausible but have not occurred previously, or for which reliable price data are not available.

3.2.37. The development of forward-looking scenarios should be informed by the judgment of experts from within the CCP or the participant community. These subject matter experts should have knowledge of the underlying markets, including the relevant economic, physical, environmental or geopolitical factors that might affect those markets in the form of events that have not previously occurred and cannot be modelled directly. These should include scenarios constructed by considering a wide range of possible catalysts. For example, these catalysts may include geopolitical events, environmental disasters, and past events that have occurred in different but related assets. For each catalyst, a CCP should construct multiple scenarios to account for different potential impacts on prices of cleared products, as a specific shock might generate a variety of plausible responses across various markets.

3.2.38. A CCP should also develop forward-looking stress scenarios that materially stress each of the liquidity risks faced by the CCP. These scenarios should incorporate all sources of liquidity risk mentioned in paragraphs 3.2.15 through 3.2.21. While the liquidity risk of certain CCPs, such as derivatives CCPs, may be driven predominantly by variation margin payments and are therefore stressed by changes in market prices, the liquidity exposures of other CCPs may be generated primarily by settlement processes. For example, a CCP clearing cash market products faces significant potential liquidity needs on the day of a participant default in the event that the CCP needs to pay for securities, currencies or physical assets that would otherwise have been delivered against payment to the defaulting participant. To the extent that the nature of the settlement process at certain types of CCPs causes additional liquidity risk, as can be the case for CCPs that clear cash securities and certain other products, such CCPs should develop scenarios that reflect the increased liquidity requirements arising from these processes (during the relevant settlement period), for example, by increasing the size of the cleared portfolios in an extreme but plausible manner.

Changes in relationships between different products or asset classes

3.2.39. In developing a wide range of relevant scenarios, a CCP should not limit scenarios to stressing the effects of markets in isolation. Interrelationships between markets will often drive transmission of effects between markets in the real economy.

3.2.40. Where a CCP clears different products or asset classes, the CCP should consider developing credit and liquidity stress-testing scenarios that capture the interrelationships among the markets for these cleared products. These scenarios should consider knock-on effects among financial markets, including propagating scenarios through extreme but plausible second-order (and, where appropriate, third-order or higher) effects on related markets.⁴⁴ While appropriately incorporating relationships among different products or asset classes into stress testing is challenging, a CCP should consider how the relationships or

⁴³ See Key Consideration 6 of Principle 4 and also Key Consideration 9 of Principle 7 of the PFMI.

⁴⁴ It is important to note that this is not a steer towards simply concatenating extreme but plausible effects in multiple markets (eg to combine the most extreme but plausible move in energy prices with the most extreme but plausible move in equities and the most extreme but plausible move in interest rates).

dependence may behave (or change) under stressed market conditions.⁴⁵ In particular, the dependence among different products or asset classes in a scenario needs to be consistent with the financial conditions embodied in the scenario. For example, in propagating scenario shocks to price moves, the CCP should not limit itself to modelling dependencies among risk factors calculated under non-stressed market conditions. Instead, the CCP could use data from periods of market stress or model hypothetical correlations that capture potential market movement. For example, a CCP may develop a scenario starting with an initial assumption of a sudden, sharp move in oil prices. The CCP could then construct knock-on effects in which related products, such as natural gas and equities, are consequently shocked. In contrast to adding together the most extreme shocks observed across products, this method of constructing scenarios can help to ensure that the resulting scenario is plausible.

3.2.41. Similarly, if a CCP constructs forward-looking scenarios by aggregating shocks across a number of risk factors across different time periods, the CCP should model the dependence between these risk factors under stressed conditions. Furthermore, a CCP should consider using dependence as a source of stress by developing forward-looking stress scenarios that contemplate the market prices of ordinarily uncorrelated products moving together or scenarios in which market prices of ordinarily correlated products diverge. When a CCP develops stress scenarios by shocking one risk factor and mapping the effect of this shock to other risk factors, for example using methods including a beta or regression-based approach, the CCP should model the dependence among these risk factors under a variety of extreme but plausible conditions.

Calculation and aggregation of stress test results

3.2.42. In applying stress-testing scenarios to its exposures, a CCP will face challenges that include ensuring reliable valuation models, appropriate aggregation of results across services and product categories, and treatment of participant exposures in a manner consistent with applicable legal frameworks that also reflects the extreme but plausible market conditions that are required for stress testing.

Stressed period of risk

3.2.43. In evaluating the risks that it incurs in stressed market conditions, a CCP should identify the appropriate length of time over which exposures could be realised. A CCP should set the stressed period of risk (SPOR) to be at least as long as the margin period of risk (MPOR) and should consider whether a longer period would be appropriate, recognising the potential challenges associated with liquidating a portfolio in extreme but plausible market conditions. In making a determination of the appropriate SPOR, a CCP should justify the decision analytically and consider the case for using different stressed periods of risk for credit and liquidity risk, recognising that these risks may crystallise over different horizons following a participant default.

Risk exposure calculation

3.2.44. When evaluating its exposure to credit or liquidity risk in extreme but plausible market conditions, the CCP should fully revalue its exposures, where practicable, using sound valuation models to measure the impact of these market conditions on the (liquidity) value of positions, collateral and investments. These models should be rigorously documented and regularly tested under stressed market conditions. Where approximation methods are used, the procedures used should be subject to ongoing validation and testing as part of the overall stress-testing framework. A CCP should ensure that it captures the foreign exchange risk that may arise from collateral and investments denominated in a different currency to the

⁴⁵ Dependence is a relationship among variables (eg risk factors, instruments, contracts), in which the movement of one variable tends to affect another. Dependence includes correlation or covariance, which capture linear dependence, but can be more complicated or non-linear: for example, assets may exhibit different dependence in extreme conditions, or in the tails. Dependence may also have a time dimension, for example prices might exhibit serial dependence and spikes in volatility might cluster together in time.

underlying exposure. In addition, a CCP should consider potential losses on investments in extreme but plausible market conditions.

Aggregation of results across product categories

3.2.45. The application of extreme but plausible scenarios to different products (eg equities, bonds, commodities, derivatives etc.) should be commensurate with the CCP's default-management procedures and its ability to implement them. A common or aligned stress scenario may be used where the CCP has a credible means of ensuring that the various products can be reliably default-managed jointly, resulting in a single stressed exposure metric for the portfolio. Where joint default management is not possible, separate stress scenarios for each specific product category should be considered, with no offsetting of gains and losses permitted across categories.

3.2.46. Consistent with Key Consideration 2 of Principle 5, which expects a CCP to set haircuts that take into account stressed market conditions, and as discussed in 3.2.14, a CCP should incorporate the stressed value of collateral (including cash collateral that has been invested by the CCP) into its stress testing. This can be achieved by stressing collateral and cleared positions separately and then aggregating losses, or by stressing both collateral and cleared positions simultaneously. Under either approach, the market conditions which are being used to value the collateral should be extreme but plausible, which may mean that the stressed value of collateral is less than the post-haircut value of collateral used by the CCP outside stress testing. A CCP should ensure that its stress testing for collateral is consistent with the default management procedures established by the CCP, such that collateral and cleared positions are stressed jointly only where they will be liquidated as a portfolio.

3.2.47. For CCPs with cross-margining agreements and, where relevant, for CCPs with links with other FMIs, aggregate stressed losses and liquidity needs should be measured based on the terms of the agreement. For instance, only amounts determined consistent with the terms of the cross-margining agreements are suitable for aggregation of stressed losses or liquidity needs.

Treatment of client exposures

3.2.48. The PFMI state that a CCP should "[o]n at least a monthly basis, perform a comprehensive and thorough analysis of stress testing ... assumptions ... to ensure they are appropriate for determining the CCP's required level of default protection".⁴⁶ In designing stress tests, a CCP should structure its treatment of the use of client collateral, including the availability of client collateral held by the defaulting participant, in a manner consistent with the applicable legal framework.

3.2.49. While a CCP may often be allowed (where provided for in the CCP's rules) to apply collateral or gains in a participant's proprietary account to offset losses in client accounts, legal frameworks will generally prohibit the use of collateral or gains with respect to client accounts to be used to offset losses in proprietary accounts. Moreover, the permissible application of collateral and, separately, gains, between client accounts often varies based on the legal framework or the CCP's account structure.

3.2.50. Consistent with the PFMI, which requires that stress testing be rigorous and take into account multiple defaults in extreme but plausible market conditions, a CCP should make the conservative assumption that no payments will be made on behalf of a defaulting participant's clients unless there are arrangements for direct payments from such clients to the CCP.⁴⁷ It is plausible that, upon the default of the direct participant, the CCP will not have access to any funds or other property that have not already been passed on to the CCP, regardless of whether such property has been or should be posted to the defaulting direct participant by its clients. It is, at the very least, plausible that the direct participant's management will not pass on any such property (because of potential personal liability) and that the direct participant's insolvency officer (eg a trustee, receiver, administrator, or liquidator) will attempt to preserve

⁴⁶ See Key Consideration 5 of Principle 4 of the PFMI.

⁴⁷ See Key Consideration 5 of Principle 4 of the PFMI.

all remaining assets. In particular, it is plausible that the CCP will not receive client variation margin payments that were not already received by the CCP prior to the direct participant's default. If the CCP has to liquidate these client positions, it will incur a loss equal to the change in the market value of the positions. The CCP may only be able to resume collecting client margin if and when client positions are ported to another direct participant.

3.2.51. Moreover, for the purposes of reflecting the extreme but plausible market conditions appropriate for stress testing, a CCP should assume that it will be unable to port client positions. Because porting requires an able and willing transferee, during times of stress, it is plausible that no such transferee will be found.

Analysis of stress testing scenarios, models, and underlying parameters and assumptions

3.2.52. The PFMI requires that a CCP has risk management policies, procedures and systems that enable it to identify, measure, monitor and manage the range of risks that arise in or are borne by the FMI, and that these risk management frameworks are subject to periodic review.⁴⁸ More specifically, Principle 4 of the PFMI states that a CCP should, "[o]n at least a monthly basis ... perform a comprehensive and thorough analysis of stress testing scenarios, models, and underlying parameters and assumptions used to ensure that they are appropriate for determining the CCP's required level of default protection in light of current and evolving market conditions".⁴⁹ The following guidance addresses this analysis.

Analysis of the risk management framework

3.2.53. A CCP's analysis of stress-testing models should comprise, at least, a mix of sensitivity analysis of the potential impacts of changing key parameters and assumptions, reverse stress testing to identify scenarios that could exhaust the CCP's prefunded financial or liquidity resources, and ongoing monitoring of selected defined scenarios deemed to be beyond extreme but plausible. Such analysis should be undertaken at least monthly consistent with the analysis expected in Key Consideration 5 of Principle 4 and before changes to the risk management framework or when changes in the risk environment occur. More frequent analysis may be particularly appropriate when a CCP clears more complex products or events suggest that underlying parameters and assumptions could be affected (for instance, a breach of coverage requirements).

3.2.54. One important objective of a CCP's analysis should be to identify whether any stress scenarios previously considered implausible should now be considered plausible (or vice versa), and thus whether any changes to the set of extreme but plausible scenarios used in daily credit and liquidity stress tests are warranted. To this end, a CCP should consider using each of the following techniques:

- i. A CCP should consider using sensitivity analysis to examine how a wide range of parameters and assumptions (eg holding periods, confidence levels, correlations, historical data periods, client porting) that reflect possible market conditions might affect credit as well as liquidity stress test results. Using sensitivity analysis, the CCP can measure the impact of changes in parameters and assumptions on stress-testing outcomes to ensure that it understands how it should respond to evolving market conditions. By varying parameters and assumptions simultaneously, the CCP will be able to better identify and understand interactions between these variables, especially where these interactions are complex and not necessarily intuitive.
- ii. Reverse stress testing can help the CCP identify the extreme scenarios and market conditions (eg price volatilities, changes in the size and composition of cleared portfolios, shifts in other market factors such as price determinants and yield curves, multiple defaults over various time horizons, as well as simultaneous pressure in funding and asset markets, and variations in defaulters'

⁴⁸ See Key Consideration 1 of Principle 3 of the PFMI.

⁴⁹ See Key Consideration 5 of Principle 4 of the PFMI.

positions) in which total prefunded financial or liquidity resources would not be sufficient, and to assess whether the break-even scenarios are plausible.⁵⁰ The CCP could also consider whether the number of simultaneous defaults that exhausts its prefunded financial or liquidity resources is plausible, in which case a CCP may consider it prudent to increase its resources.

- iii. A CCP should also consider incorporating additional for-information-only scenarios into its stress-testing framework. These scenarios should be implausible, rather than extreme but plausible, scenarios. For example, a for-information-only scenario may include a particular historical scenario which the CCP has determined is no longer to be plausible.

3.2.55. This additional analysis should be subject to the same governance arrangements as decisions on stress-testing scenarios. While the results of this additional analysis need not necessarily drive a CCP's determination of the appropriate level of financial or liquid resources, a CCP should use the results to judge whether it would be prudent to prepare for these severe conditions and various combinations of factors influencing these conditions. As such, a CCP should clearly identify the purpose of each type of additional analysis undertaken and any actions that the CCP will take based on the outcomes of such analysis.

⁵⁰ A break-even scenario is defined as a scenario, identified through reverse stress testing, which exactly exhausts the CCP's financial resources (based on participant positions at the time the analysis is conducted).

4. Coverage

4.1 Context

4.1.1. Principle 4 of the PFMI requires a CCP to maintain prefunded financial resources to cover its credit exposures on an ongoing basis. CCPs are expected to cover fully their current and potential future exposures to each participant with a high degree of confidence. All CCPs are also expected to maintain additional prefunded financial resources in an amount sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the one or two participants and their affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions. These minimum coverage amounts are typically referred to as “Cover 1” or “Cover 2”. A CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions is expected to, at least, meet the Cover 2 requirement and all other CCPs should at least meet the Cover 1 requirement.⁵¹

4.1.2. Similar to Principle 4 setting coverage requirements for credit risk, Principle 7 requires CCPs to maintain on an ongoing basis sufficient liquid resources in all relevant currencies to cover its payment obligations. All CCPs are expected to have sufficient liquid resources to meet all payment obligations in each currency on time, including sufficient liquidity to settle payment obligations associated with variation margin calls and the delivery of securities, foreign exchange, and physical assets. In order to do so, CCPs are required to conduct rigorous stress testing to determine the amount and to test the sufficiency of their liquidity resources. For liquidity risk, all CCPs are required to meet a Cover 1 minimum standard. For CCPs that are involved in activities with a more-complex risk profile or that are systemically important in more than one jurisdiction, these CCPs should consider maintaining additional liquidity resources that meet a wider range of stress scenarios, including Cover 2 stress scenarios.

4.1.3. The guidance in this section is intended to strengthen a CCP’s observance of Principle 4 and Principle 7 of the PFMI in setting and maintaining on an ongoing basis the required level of resources through its credit risk and liquidity risk stress-testing practices. The Cover 1 and Cover 2 requirements set out in Principle 4 and Principle 7 of the PFMI are minima and a CCP should consider its risk profile in determining the resources it should maintain above these minimum requirements. A CCP is expected to determine the required amount of credit and liquidity resources it should maintain and regularly test the sufficiency of those resources through stress testing. To the extent the results indicate that the CCP is not, or is at material risk of not, maintaining the required amount of resources to cover its potential credit and liquidity exposures, the CCP is expected to take prompt corrective action.

4.2 Guidance

Cover 1 or Cover 2 is a minimum

4.2.1. The Cover 1 and Cover 2 requirements in the PFMI for credit and liquidity risk are minimum standards.⁵² As discussed in Section 2, the board is responsible for setting the required level of financial and liquidity resources commensurate with its risk tolerance and for maintaining that amount on an ongoing basis. In determining the required level of resources it should maintain, a CCP should consider its specific risk profile and the results of its stress testing under all relevant extreme but plausible scenarios

⁵¹ Key Consideration 4 of Principle 4 of the PFMI.

⁵² As previously noted, the minimum coverage requirement for credit is set out in Key Consideration 4 of Principle 4 of the PFMI. The analogous requirement for liquidity is contained in Key Consideration 4 of Principle 7 of the PFMI, which requires a CCP maintain sufficient liquid resources in all relevant currencies to settle securities-related payments, make required variation margin payments, and meet other payment obligations on time with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions.

and market conditions. This assessment should include analysing the number of simultaneous participant defaults that are extreme but plausible given the composition of its particular participant base and also monitoring the distribution of projected stress-testing losses across participants.

Determining the largest exposures

4.2.2. When considering its minimum coverage requirements, a CCP should clearly define how it identifies the participant(s) and affiliates whose default would cause the largest aggregate credit or liquidity exposure for the CCP in extreme but plausible market conditions.⁵³ In doing so, a CCP needs to recognise that both the underlying stress scenario and the defaulting participant(s) may be different from those identified for the purposes of credit risk and liquidity risk. In calculating stress-testing losses generated by a participant default, a CCP should consider a participant's initial margin and positions. A CCP should assume that a participant and all of its affiliates default simultaneously and only allow for offsetting to the extent the rules of the CCP and the applicable legal framework allow for such offsetting in the event of a default.

4.2.3. When a CCP is assessing its ability to withstand the default of multiple participants, it should be transparent about its approach for selecting the stress scenarios that drive this requirement. The aggregate of the largest two exposures under any particular stress scenario is consistent with assessing the CCP's ability to withstand the simultaneous default of those two participants in extreme but plausible market conditions. However, if a participant defaults while a CCP is still managing a previous default, the market conditions may change between the two defaults. Consequently, a CCP may consider sequential defaults to be better reflected by the use of unsynchronised stress-testing results. Because allowing the stress scenario to vary across participants may result in larger estimated exposures, the CCP needs to clearly explain its approach so that authorities, participants and other stakeholders are better able to interpret the stress-testing results.

Ignoring voluntary, excess contributions

4.2.4. When assessing the adequacy of its resources, a CCP should ignore any voluntary, excess contributions from participants. Since the contributions are voluntary and may be withdrawn, a participant may remove or decrease any excess deposits during times of stress. Therefore, when conducting both credit and liquidity stress testing, a CCP should assume that no voluntary, excess collateral posted by a participant will be available to meet losses or to make payment obligations.

Maintaining resources on an ongoing basis

4.2.5. A CCP should maintain its required level of prefunded financial and liquid resources on an ongoing basis.⁵⁴ A CCP should conduct daily and, as necessary, intraday margin coverage analysis and stress testing for both credit and liquidity risks in order to assess observance with its coverage requirements. If stress testing indicates that the CCP is not, or is at material risk of not, maintaining its required levels of resources, the CCP should have policies and procedures in place that result in prompt corrective action. To observe the relevant minimum coverage requirement for credit or liquidity resources on an ongoing basis, a CCP should use a sizing methodology sufficiently conservative to minimise the likelihood of a shortfall. In so doing, the CCP should evaluate the role of the composition of financial resources in relation to minimising the likelihood of a shortfall, particularly when sizing mutualised financial resources.

4.2.6. The CCP should have clear procedures or rules in place that stipulate what steps the CCP will take to re-establish compliance promptly in the event that the CCP's stressed exposures/payment obligations

⁵³ As part of documenting its supporting rationale for, and having appropriate governance arrangements relating to, the amount of total financial resources it maintains, see Key Consideration 4 of Principle 4 and Key Consideration 4 of Principle 7 of the PFMI.

⁵⁴ See Key Consideration 4 of Principle 4 and Key Consideration 4 of Principle 7 of the PFMI.

breach the relevant minimum coverage requirement. The CCP's policies and procedures should clearly define the thresholds, escalation criteria, and breaches that should trigger an automatic and, where appropriate, same-day contribution from a direct participant or direct participants based upon: (i) quantitative thresholds (eg proportion of identified actual or potential deficiencies in credit or liquidity resources) at a direct participant, family, and aggregate levels; (ii) qualitative criteria (eg participant risk rating) established at the direct participant and family levels; and (iii) multiple thresholds established to monitor sufficiency of financial resources in various default scenarios, including defaults of multiple participants.

4.2.7. The CCP should clearly articulate the circumstances in which it will call for additional financial or liquidity resources from participants, the nature of resources it will call (eg additional margin or additional contributions to the default fund), how the allocation of additional contributions will be determined, and the payment deadline. For example, a CCP could consider assessing stress-testing exposures to pre-established limits and monitor daily usage. As a part of this process, a CCP could additionally compare stress losses to its use of its financial and liquid resources, and, in the event the amount used breaches certain thresholds, call for additional financial resources from a single participant or a number of participants. The CCP should periodically engage with participants to ensure that the participants understand their potential obligations and have taken appropriate steps to ensure that they would be able to meet them.

5. Margin

5.1 Context

5.1.1. Principle 6 of the PFMI states that a CCP should cover its credit exposures to its participants for all products through an effective margin system that is risk-based and regularly reviewed. This additional guidance on margin systems, in the form of either emphasising or clarifying existing PFMI margin concepts, is intended to assist a CCP in its ongoing efforts to implement and maintain margin systems that are effective in addressing the risks and particular attributes of each product, portfolio and market served. As discussed in greater detail below, a CCP should apply the PFMI to all components of its margin system.

5.1.2. This guidance builds on several key considerations, explanatory notes and concepts in the PFMI. For example, the guidance related to margin system components and margin system design relates to Key Consideration 1 of Principle 6, which notes that CCP margin systems should “establish margin levels commensurate with the risks and particular attributes of each product, portfolio, and market” the CCP serves. The guidance in monitoring intraday exposure, backtesting, sensitivity analysis and wrong-way risk relates to Key Consideration 3, which states that “initial margin models and parameters ... generate margin requirements sufficient to cover [the CCP’s] potential future exposure to participants in the interval between the last margin collection and the close out of positions following participant default.” The guidance under the margin period of risk or closeout period, model assumptions, pricing data and procyclicality also relates to the portions of Key Consideration 3, which states that models should “(a) use a conservative estimate of the time horizons for the effective hedging or close out of the particular types of products cleared by the CCP (including in stressed market conditions), (b) have an appropriate method for measuring credit exposure that accounts for relevant product risk factors and portfolio effects across products, and (c) to the extent practicable and prudent, limit the need for destabilising, procyclical changes.” Finally, in developing effective portfolio margining systems, Key Consideration 5 requires that a CCP should explicitly consider and ensure consistency with potential default management of positions in a portfolio.

5.1.3. It should be noted that some of the margin guidance echoes, and is intended to supplement, guidance previously described in this report in Section 2 with respect to CCP governance, including disclosure mechanisms. Other margin guidance reflects themes previously highlighted in Section 3 of this report. A CCP, its participants and other parties are encouraged to analyse and consider the margin guidance in the overall, broader context of this report.

5.2 Guidance

Margin system design

5.2.1. The PFMI provide that a CCP should have a margin system that establishes margin levels commensurate with the risks and particular attributes of each product, portfolio and market it serves.⁵⁵ For this purpose, a CCP should implement a margin system (including margin and pricing models) that appropriately captures the characteristics and complexity of the products it clears.

5.2.2. In supporting the board’s responsibility as discussed in paragraph 2.2.4, the CCP should have processes to identify, clarify and evaluate the choices and trade-offs present in the design of the margin system. Part of this process should entail evaluation of various models and approaches, and selection of those most appropriate for the product cleared. For example, a CCP could consider the following non-exclusive list of system design factors: (i) the number and interdependence of risk factors; (ii) data availability, data reliability and the characteristics of such data (eg non-linearities, seasonality); (iii) model performance; (iv) model stability; (v) flexibility and scalability; (vi) independence of errors and breaches;

⁵⁵ See Key Consideration 1 of Principle 6 of the PFMI.

and (vii) transparency and predictability. In addition, a CCP should take into account explicitly the relevant risks for its particular products and markets. For example, such risks may include: (i) the consequences of changes in underlying asset prices, rates, spreads, implied volatilities, correlations and bases; (ii) the presence of wrong-way risk; and (iii) the impact of market illiquidity. All of these risks may be further exacerbated for large concentrated positions.

5.2.3. The PFMI provide that a CCP should regularly review and validate its margin system.⁵⁶ The CCP should review all of the relevant factors and risks it chooses to reflect in its margin system on an ongoing basis, and through a range of mechanisms. Examples of such mechanisms include practices already reflected in the PFMI such as validation, backtesting and sensitivity analysis, which take into account the characteristics of the products cleared and the reliability of the relevant price sources and other inputs. Other mechanisms a CCP should consider relate to the governance process as discussed in paragraphs 2.2.15 through 2.2.20.

Margin Period of Risk (MPOR) or closeout period

5.2.4. A CCP should identify and consider a number of elements when constructing an appropriate margin system that seeks to address risks that arise from the products cleared. One common conceptual building block is the MPOR or the closeout period that a CCP assumes in its margin model. The PFMI note that the appropriate closeout period may vary among products and markets, depending upon the product's liquidity, price and other characteristics.⁵⁷ As a general matter, the assumed MPOR or closeout period should incorporate the market depth and characteristics of the products cleared and should be justified analytically by the CCP. Where a CCP clears products with different market characteristics, the CCP should consider multiple MPOR assumptions or seek to ensure that a single MPOR assumption is appropriate for all cleared products.

5.2.5. The PFMI indicate that the closeout period should account for the impact of a participant's default on prevailing market conditions.⁵⁸ In addition, a CCP should also take into account a number of specific factors that may come into play in the event of a participant default. As a general starting point, the assumed MPOR or closeout period should be consistent with market conditions likely to be present upon the default of any of the CCP's participants. Such conditions may include the level of product standardisation in the market, whether the product is exchange- or OTC-traded, and general indications of the degree of market liquidity such as the degree of concentration in market-makers and liquidity providers.

5.2.6. A CCP should adopt a margin system and parameters that are risk-based and generate margin requirements that are sufficient to cover its potential future exposures to participants in the interval between the last margin collection and the closeout of positions following a participant default.⁵⁹ Furthermore, the assumed MPOR or closeout period should incorporate explicitly the time between the point at which the CCP collected the last margin payment and the point at which market risk was neutralised either through liquidation of the defaulted participant's portfolio or hedging. Another relevant factor a CCP should consider is compatibility with its segregation and portability regime and whether participant customer margin is held on a net or gross basis.

5.2.7. The PFMI provide that an FMI should ensure that its rules, procedures and agreements allow it to gather basic information about indirect participation in order to identify, monitor and manage any material risks to the FMI arising from such tiered participant arrangements.⁶⁰ In order to properly evaluate whether the assumed MPOR or closeout period is consistent with these factors, a CCP should consider a

⁵⁶ See Key Consideration 7 of Principle 6 of the PFMI.

⁵⁷ See Key Consideration 1 of Principle 6 and paragraph 3.6.3 of the PFMI.

⁵⁸ See paragraph 3.6.7 of the PFMI.

⁵⁹ See Key Consideration 3 of Principle 6 of the PFMI.

⁶⁰ See Key Consideration 1 of Principle 19 of the PFMI.

number of governance-related measures including regular assessments of the CCP's participants and certain participant customer demographics. Finally, as part of its ongoing review of margin system performance and model validations, a CCP should regularly test and assess the appropriateness and effectiveness of the length of the assumed MPOR or closeout period and seek periodic feedback from its participants, indirect participants and other relevant stakeholders to gauge the current assumed market liquidity and closeout costs.

Minimum MPOR or closeout period

5.2.8. The PFMI provide that a CCP should adopt initial margin models and parameters that are risk-based and generate margin requirements sufficient to cover its potential future exposure to participants in the interval between the last margin collection and the closeout of positions following a participant default. Initial margin should meet an established single-tailed confidence level of at least 99% with respect to the estimated distribution of future exposure.⁶¹ Notwithstanding this guidance, the PFMI does not prescribe a minimum MPOR or closeout period. However, in other contexts the question of whether a CCP should uniformly apply a minimum MPOR or closeout period has become a notable area of focus, particularly for a CCP operating in multiple jurisdictions.

Model assumptions

5.2.9. The PFMI provide that when setting margin requirements, a CCP should have a margin system that establishes margin levels commensurate with the risks and particular attributes of each product, portfolio and market it serves.⁶² How a CCP determines and applies its model assumptions is important to meeting this expectation. As a general matter, a CCP should clearly identify explicit and implicit assumptions made in its margin model, and should develop and maintain clear, thorough justifications. Margin models require assumptions ranging from design choices to parameter estimation methods, and in order to ensure the overall effectiveness of the margin system, a CCP should manage and mitigate the impact of model risk associated with the margin system's assumptions. This approach may vary depending on the risks the margin system seeks to address. For risks that are more difficult to measure, or perhaps even observe, because of a lack of reliable data or other reasons, a CCP should make conservative assumptions to reduce model risk and to ensure that margin coverage is commensurate with risk exposure(s). For example, rather than relying on a single method to calculate volatility, a CCP might choose to use the highest estimate from different methods.

5.2.10. Another related approach might entail setting thresholds on margin parameters such that if margin is based on a measure of volatility, a CCP could apply a "volatility floor" below which no reduction in margin would be granted by the model. In addition, as with other aspects of a CCP's margin system, a CCP should monitor and analyse whether the assumptions for its margin model continue to be appropriate. In any event, sensitivity analyses should be used to identify assumptions that have a large impact on the model outputs and performance. In addition, a CCP should ensure that model validations specifically contemplate the specific assumptions and related justifications.

5.2.11. One particular area of consideration in margin model assumptions is the potential market liquidation costs that a CCP assumes it will incur when liquidating a participant's portfolio. Such costs are relevant to the assumed market conditions a CCP believes will be present upon the default of any of its participants. A CCP's margin model assumptions should incorporate estimates of market liquidation costs, including bid/ask spreads not otherwise modelled in the price returns or explicit fees paid to trading platforms or liquidation agents. These market liquidation costs should also reflect the market impact of liquidation activity, when applicable. When a portfolio liquidation requires the disposal of large concentrated positions or portfolios that are otherwise significant in terms of anticipated impacts on market liquidity in the relevant product, a CCP should contemplate the possibility that assumed market

⁶¹ See Key Consideration 3 of Principle 6 of the PFMI.

⁶² See Key Consideration 1 of Principle 6 of the PFMI.

liquidation costs, such as bid/ask spreads or mid-market pricing, will not in fact be actionable or otherwise predictable in the face of an actual liquidation.

Margin system components

5.2.12. The PFMI provide that an effective margining system is a key risk management tool for CCPs in managing the credit exposures posed by its participants' open positions.⁶³ A CCP should collect margin to assure performance and mitigate its credit exposures, if a participant defaults, to all products that it clears. As described in the PFMI, margin systems differentiate between initial margin and variation margin.⁶⁴ Within that basic structure, initial margin models may comprise a number of components. These components frequently include a model, such as value-at-risk or other statistical model, designed to capture the price movements of cleared products. A CCP may also utilise a number of margin add-on charges to capture risks that may not be captured in price histories or may be difficult to accurately model. While what follows includes, by way of example, references to certain components found in a CCP's margin system, such as add-on charges, the discussion is not exhaustive.

5.2.13. Margining is used by a CCP to require each participant to provide collateral to protect the CCP against a high percentile of the distribution of future exposure.⁶⁵ Add-on charges can be one of several components in a CCP's margin system designed to meet this purpose. As a general matter, add-on charges can be understood as components of a CCP's overall margin requirement that are typically calculated to supplement statistical models. These add-on charges may include additional charges based on market liquidity risk, wrong-way risk or correlation risk, position concentration, participant concentration, momentum or volatility metrics, and activity or utilisation metrics. Furthermore, add-on charges can address risks that may be more challenging to model accurately, or are not readily discernible in the price histories of the products cleared. As a result, add-on charges may utilise a more qualitative approach or be calculated in an intentionally conservative fashion.

5.2.14. In addition, other margin add-on charges may be explicitly designed to increase the amount of defaulter-pay resources rather than increasing mutualised resources. Such add-on charges may include additional charges based on credit or counterparty concerns (eg charged to participants on a CCP's watch list), stressed scenarios or stressed market conditions.

5.2.15. A CCP should ensure that it observes the PFMI for all components of its margin system, including any add-on charges. In doing so, a CCP should refer to the guidance in this report, including Section 2 on governance and the discussion on procyclicality.⁶⁶ A CCP should ensure that expectations in Principles 4 and 6 are observed for add-on charges to the same extent as for the other margin system components. In particular, the add-on charges described in paragraph 5.2.13 should be designed so that they observe Principle 6. The add-on charges described in paragraph 5.2.14 should be designed so that they observe Principle 4.

5.2.16. A CCP should generally avoid applying add-on charges as a substitute approach in instances when the relevant risks may be realistically addressed by other components of the margin system or other aspects of a CCP's risk management framework. In addition, the application of add-on charges should also be documented and disclosed with the same level of rigour and transparency that is applied to all other components of a CCP's margin system.⁶⁷

⁶³ See also Principle 4 of the PFMI.

⁶⁴ See paragraph 3.6.1 of the PFMI.

⁶⁵ See paragraph 3.6.2 of the PFMI.

⁶⁶ See, for example, paragraph 5.2.35.

⁶⁷ See paragraph 5.2.36 below.

Price data

5.2.17. Another conceptual building block for the margin system is the incorporation of pricing data, including historical data, look-back periods and price estimates. The PFMI note that a CCP should base its determination of the closeout periods for its initial margin model on historical price and liquidity data, as well as on reasonably foreseeable events in a default scenario.⁶⁸ When using historical prices in its margin model, a CCP should carefully evaluate the appropriate historical sample period. The choice of a historical sample period should be based on consideration of explicit factors relating to the specific characteristics of the relevant cleared products, including potentially (i) the need to accurately estimate model parameters or model outputs; (ii) the need to accurately model the potentially complex dependencies between cleared products; (iii) possible seasonality in the historical data; and (iv) the need to be representative of market conditions consistent with the default of a participant.

5.2.18. A CCP should conservatively model its margin requirements for products lacking sufficient periods of historical data (such as new products). The margin model also should reflect the market behaviour of the underlying or similar products, accounting for any differences. For this purpose, a CCP should adopt a sufficiently long historical sample period to capture several historical periods of market stress or otherwise consider a range of sample periods, with a view to adopting the most conservative margin requirement generated. For example, a CCP should also periodically review, recalibrate and validate decay factors and should take into account risk factor types and respective holding periods. Where appropriate and relevant, a CCP could implement a weighting or scaling methodology, and incorporate a decay factor in order to ensure that the margin model is sufficiently responsive to current market conditions and quickly responds to changes in market volatility.

5.2.19. A related concern is the degree of reliance a CCP may have on sources of price data. The PFMI notes that a CCP should have a reliable source of timely price data because such data are critical for a CCP's margin system to operate accurately and effectively. In most cases, a CCP should rely on market prices from continuous, transparent and liquid markets.⁶⁹ However, a CCP that clears exchange-traded products should have backup sources clearly identified and available in the event that trading markets are not operational or otherwise accessible for price information purposes. As the PFMI note, even when quotes are available, bid-ask spreads may be volatile and widen, particularly during times of market stress, thereby constraining the CCP's ability to measure accurately and promptly its exposure.⁷⁰ The CCP should have procedures and sound valuation models for addressing circumstances in which pricing data are not readily available or reliable.⁷¹

5.2.20. The PFMI note that, for some markets such as OTC markets, prices may not be reliable because of a lack of a continuous liquid market. In contrast to an exchange-traded market, there may not be a steady stream of live transactions from which to determine current market prices. In some cases, participants may be an appropriate source of price data, as long as the CCP has a system which ensures that prices submitted by participants are reliable and accurately reflect the value of cleared products.⁷² For products that are traded on OTC markets or where trading platforms are a recent market development, a CCP should ensure that quotes or other pricing models are reliable and accurately reflect the value of cleared products. For example, a CCP that clears OTC derivative products could use a pricing model, as necessary, to value positions or extract risk characteristics. A pricing model may also be needed to transform quotes from one convention to another, for example from spread to price for credit default swaps.

⁶⁸ See paragraph 3.6.7 of the PFMI.

⁶⁹ See paragraph 3.6.4 of the PFMI.

⁷⁰ See paragraph 3.6.5 of the PFMI.

⁷¹ See Key Consideration 2 of Principle 6 of the PFMI.

⁷² See paragraph 3.6.5 of the PFMI.

5.2.21. The PFMI provide that a CCP should have a reliable source of timely price data for its margin system.⁷³ The currency of pricing data, particularly when price estimates are present, is also an important element for a CCP to consider. A CCP should implement both sound pricing models, when appropriate, and valuation models – even for data usually sourced from an exchange. The PFMI also provide that a CCP should have procedures and sound valuation models for addressing circumstances in which pricing data are not readily available and reliable.⁷⁴ A CCP should evaluate the reliability and consistency of prices that it receives to detect both stale and erroneous data. For example, a CCP could scrub price data by using outlier-detection algorithms to identify, investigate and potentially remove erroneous price data. A CCP should also maintain appropriate policies and procedures to address such problems; such policies and procedures may include estimating prices or adjusting margin requirements if data become unreliable or even unavailable.

Monitoring intraday exposure

5.2.22. One element a CCP should consider in its margin system is how intraday exposure is addressed. The PFMI provide that a CCP should have the authority and operational capacity to make intraday margin calls and payments, both scheduled and unscheduled, to participants.⁷⁵ A CCP faces the risk that its exposure to its participants can change rapidly as a result of changes in prices, positions or both. Adverse price movements, as well as participants building larger positions through new trading (and settlement of maturing trades), can rapidly increase a CCP's exposures to its participants.⁷⁶ This exposure can relate to intraday changes in both prices and positions. For the purposes of addressing these and other forms of risk that may arise intraday, a CCP should address and monitor on an ongoing basis how such risks affect all components of its margin system, including initial margin, variation margin and add-on charges.

5.2.23. In this vein, a CCP should identify, establish and implement clear triggers and thresholds to recalculate margin requirements on an intraday basis. This may be particularly relevant for a CCP that services markets and products where intraday exposures tend to be larger than end-of-day exposures because of specific features, such as the settlement process. For example, a CCP could recalculate its intraday margin requirements on an ongoing basis, taking into account new cleared positions and current market prices. A CCP could also establish and implement intraday margin triggers related to changes to exposure. If recalculation of margin intraday is not feasible, the CCP should take appropriate steps to ensure that the intraday risks are adequately covered, such as through expansive MPOR or closeout periods (see paragraphs 5.2.4 through 5.2.8) or stress testing (see paragraphs 3.2.35 and 3.2.43), in order to ensure observance of the PFMI coverage requirements via prefunded financial resources on an ongoing basis. In addition, and as appropriate, a CCP could consider implementing a backstop mechanism such as an intraday margin call conducted whenever the uncovered margin liability for a particular participant exceeds a specified risk-based measure.

5.2.24. The regular collection of margin prevents uncollateralised current exposures from accumulating and mitigates the potential future exposures a CCP might face. In addition, a CCP should be able to monitor, and perform intraday margin calculations for, regular or ad hoc intraday margin calls. For example, a CCP could implement such measures as it monitors erosion of the margin held in relation to the observed changes in intraday credit exposures to its participants' portfolios.

⁷³ See Key Consideration 2 of Principle 6 of the PFMI.

⁷⁴ See Key Consideration 2 of Principle 6 of the PFMI.

⁷⁵ See Key Consideration 4 of Principle 6 of the PFMI.

⁷⁶ See Key Consideration 4 of Principle 6 of the PFMI.

Backtesting

5.2.25. A CCP should conduct rigorous backtesting and sensitivity analysis as an integral part of the evaluation of its margin system. The PFMI provide that a CCP should analyse and monitor its model performance and overall margin coverage by conducting rigorous daily backtesting.⁷⁷ A CCP should conduct backtesting of its margin system for two primary purposes: (i) to assess whether the CCP has collected sufficient margin to meet the historical coverage requirement and (ii) to assess the statistical performance of the margin system.

5.2.26. The PFMI provide that a CCP should regularly conduct an assessment of the theoretical and empirical properties of its margin model for all products it clears.⁷⁸ When performing backtesting to assess whether the CCP has collected sufficient margin to meet its coverage requirement and whether there are any exceptions to its initial margin coverage, the CCP should:

- i. Use actual portfolios of the participants that are guaranteed by the CCP but not yet settled.
- ii. Make explicit assumptions about the timing of the participant default and what actions the participant took before default, such as paying any intraday margin charges or meeting settlement obligations. These assumptions should conservatively reflect the timing and decisions likely to be made immediately before the default of a participant. In particular, a CCP should not assume that a participant will fully satisfy any outstanding margin or settlement obligations just prior to entering into default.
- iii. Calculate the historical profit and loss consistent with the assumed MPOR or closeout period and include the period from the last margin payment calculation to the start of the default management process.
- iv. Appropriately account for risks that may not be included in the historical price data, such as market liquidation costs and specific wrong-way risk. If the historical price data do not include additional potential losses due to market liquidation costs, specific wrong-way risk, or other unobservable risk exposures, these additional losses need to be included in the historical P&L or excluded from the margin for purposes of backtesting.

5.2.27. Where a CCP performs backtesting to assess the statistical performance of the margin system, in addition to its backtesting to assess margin coverage, the CCP should use actual portfolios and include only margin calculated by the model whose statistical accuracy is being tested. This type of testing would typically eliminate the use of margin components designed to capture risks that are difficult to quantify or observe directly.

5.2.28. A CCP should analyse the backtesting results to assess whether its margin methodology meets minimum standards. This analysis should include an assessment of the performance of the margin methodology on an overall basis as well as on a participant basis. As indicated in the PFMI, this assessment of margin coverage is required by Key Consideration 6 and should be considered an integral part of the evaluation of the model's performance.⁷⁹ These analyses can include assessing the number of exceedances, the size of exceedances, and the clustering of exceedances using statistical tests. Where backtesting exceedances are observed, the CCP should investigate and determine if any response is necessary, such as adjusting the parameters, addressing new or neglected risks more rigorously or making material changes to the margin system. A CCP should have clear procedures for recalibrating its margin system, such as by making adjustments to parameters and sampling periods.

⁷⁷ See Key Consideration 6 of Principle 6 of the PFMI.

⁷⁸ See Key Consideration 6 of Principle 6 of the PFMI.

⁷⁹ See paragraph 3.6.16 of the PFMI.

5.2.29. The PFMI provide that a CCP should conduct rigorous daily backtesting and indicate that coverage should be evaluated across products and participants, and take into account portfolio effects across asset classes within the CCP.⁸⁰ A CCP should conduct backtesting on a daily basis, using the most granular level of account details available, whether at the participant account level or the client account level. A CCP should evaluate the source of backtesting exceedances, as appropriate, to determine if a fundamental change to the margin methodology is warranted or if only the recalibration of current parameters is necessary.⁸¹ Results of backtesting analyses, including documentation supporting the results of the investigation, should also be reported through the CCP's governance structure, including the risk committee as discussed in 2.2.14.

5.2.30. Backtesting results should be evaluated using a variety of methods to ensure that the results are consistent with expected model performance. The PFMI notes that such analysis should be applied to analyse and monitor overall margin coverage.⁸² When the margin system has various components, each component should be contemplated when conducting backtesting as appropriate.

Sensitivity analysis

5.2.31. The PFMI provide that a CCP should analyse and monitor its model performance and overall margin coverage by conducting a sensitivity analysis at least monthly, and more frequently where appropriate.⁸³ A CCP should conduct a sensitivity analysis monthly in order to assess the responsiveness of margin system parameters and determine which parameters and assumptions have the largest impact on margin outputs. This should include reviewing the procyclical properties of the margin system, for example, by simulating how the margin system would respond to a sharp increase in market volatility. When the sensitivity analysis results identify an issue, a CCP should undertake further investigation and present recommendations to change or maintain margin settings.

5.2.32. The PFMI note that such an analysis should be applied to assess and monitor overall margin coverage.⁸⁴ For the purposes of conducting a sensitivity analysis, each add-on charge should be analysed separately and the results of that analysis may then be considered in connection with the overall analysis of all components of the margin system. The PFMI note that the range of parameters and assumptions should capture a variety of historical and hypothetical conditions.⁸⁵ For key parameters, a CCP should use a range of confidence intervals to compare model output and assess longer-term model behaviour. With respect to testing model parameters and assumptions, a CCP could test the sample period, closeout period, and confidence levels. In addition, the CCP could use historical and hypothetical periods of stressed data.

Addressing procyclicality

5.2.33. A CCP should ensure that its margin system is designed to address the need to appropriately respond to risks that arise from ongoing market dynamics without compromising financial stability. The PFMI provides that, to the extent practicable and prudent, a CCP's margin model should limit the need for destabilising, procyclical changes.⁸⁶ In this context procyclicality typically refers to changes in risk management practices that are positively correlated with market, business or credit cycle fluctuations and

⁸⁰ See Key Consideration 6 of Principle 6 and paragraph 3.6.16 of the PFMI.

⁸¹ See paragraph 3.6.16 of the PFMI.

⁸² See Key Consideration 6 of Principle 6 of the PFMI.

⁸³ See Key Consideration 6 of Principle 6 of the PFMI.

⁸⁴ See Key Consideration 6 of Principle 6 of the PFMI.

⁸⁵ See paragraph 3.6.17 of the PFMI.

⁸⁶ See Key Consideration 3 of Principle 6 of the PFMI.

may cause or exacerbate financial instability.⁸⁷ A CCP should take steps to identify and address procyclical concerns in its margin system, addressing the need to have a model that responds to market dynamics without compromising financial stability. For the purposes of effectuating this guidance, a CCP should assess the appropriateness of procyclicality in its margin system and develop clearly articulated frameworks for addressing and disclosing this particular risk (see paragraph 5.2.39).

5.2.34. The PFMI acknowledge that procedures designed to limit the need for procyclical changes may create additional costs for a CCP and its participants in periods of low market volatility, but these procedures may also result in additional protection and potentially less costly and disruptive adjustments in periods of high market volatility.⁸⁸ In devising a holistic approach to procyclicality in its margin system that is both practicable and prudent, a CCP should be cognisant of potential trade-offs in its approach that may emerge under certain market conditions. As described in further detail below, those trade-offs should be clearly identified and considered by the CCP in adopting a particular framework or approach to procyclicality in its margin arrangements. In considering such trade-offs, the CCP should seek to ensure that its approach to procyclicality is appropriately designed to target outcomes that result in additional protection and potentially less costly and disruptive adjustments in periods of high market volatility.

5.2.35. Not all aspects of a CCP's approach to procyclicality relate exclusively to the CCP's margin system. As mentioned in the PFMI, to limit the need for destabilising, procyclical changes, a CCP could consider increasing the size of its prefunded default arrangements to limit the need and likelihood of large or unexpected margin calls in times of market stress.⁸⁹ One possible method of addressing procyclicality concerns in its margin system is for a CCP to incorporate elements into the sizing of its default fund (eg placing a floor on the total amount of resources available in the fund or installing a buffer above the stress losses observed) that limit the need and likelihood of large or unexpected margin calls in times of market stress. However, in drawing these distinctions, a CCP should take care to maintain the balance between the specific risks addressed by its margin system (which draws resources from a defaulter) and the differing risks addressed by its default fund (which draws resources from surviving, non-defaulting direct participants).

5.2.36. In addition, a CCP should distinguish add-on charges from other charges linked to different components of the margin system. For example, to the extent that add-on charges are typically calculated outside of the CCP's initial margin model, a CCP should clearly and transparently document where such charges are applied (and why other components of the margin system do not or perhaps cannot address the same risks). In this regard, some degree of detail is useful regarding how each add-on charge is calibrated to correspond to a particular aspect of the CCP's holistic approach to managing procyclicality. For example, a CCP could determine how far the frequency of application of add-on charges that target the composition of prefunded financial resources (eg counterparty credit or stressed based charges) is commensurate with the intended risk, the CCP's holistic approach to procyclicality, and its risk tolerance.

5.2.37. A CCP should assess the procyclicality of add-on charges in order to reduce the risk that such charges could become destabilising in periods of increased market volatility. For example, the application of add-on charges should avoid large step changes to the extent that the resilience of the CCP is not undermined. More generally, changes in margin charges should be clearly related to metrics that would allow participants to predict charges in line with the margin system transparency provided by the CCP. Subject to the proper degree of rigour and analysis discussed herein, margin charges appropriately deployed may, depending on the given circumstances, be a useful component in a CCP's overall approach to managing the likelihood of destabilising, procyclical changes. For example, more frequent margin charges can also be applied for the purpose of gradually smoothing out increases in participant margin requirements over time, while still taking into account the need for a CCP to cover its exposures with a high degree of confidence such that a potentially destabilising large step change in margin requirements

⁸⁷ See paragraph 3.6.10 of the PFMI.

⁸⁸ See paragraph 3.6.10 of the PFMI.

⁸⁹ See paragraph 3.6.10 of the PFMI.

does not materialise. For example, the reliance on observable metrics according to transparent and simple rules would allow participants to predict add-on charges and to prepare accordingly.

Measuring and addressing procyclicality in the CCP's margin system

5.2.38. As provided in the PFMI, to the extent practicable and prudent, a CCP should appropriately address procyclicality in its margin arrangements, including through well documented policies and procedures. In this regard, a CCP, as a first step towards addressing this objective, could consider measuring procyclicality by using quantitative metrics to evaluate the procyclical properties of its margin system as part of the model validation process. For example, a CCP could evaluate how far the resizing of the default fund affects margin procyclicality. Also, a CCP could examine procyclicality through regular sensitivity testing and review metrics, such as the variability of margin and peak-to-trough ratios or instances of sudden material increases in margin. In addition, a CCP should incorporate historical sample periods of various lengths into the sensitivity analysis in order to appropriately capture the risk of destabilising, procyclical changes. Relevant metrics could also be based upon an ex ante range of tolerances determined by the CCP's governance process that specifies acceptable large changes in the amount of resources collected from participants. In addition, a CCP should follow a holistic approach when measuring procyclicality in its approach to total financial resources.

5.2.39. Taking into account this metrics-based analysis to the extent practicable and prudent, a CCP should in turn develop appropriate methods or tools for mitigating the potential for destabilising, procyclical changes arising from its margin system. As already reflected in the PFMI, a CCP should incorporate elements that mitigate procyclicality into its margin system, as appropriate, and tailor the specific approach to reflect the risk characteristics of the products and markets cleared. For example, a CCP should consider installing buffers or floors on its default fund or its margin requirements (eg a margin requirement that cannot fall below a certain percentage of notional value, tailored to the risk characteristics of each product cleared) in order to avoid margin falling below a cleared threshold in times of low market volatility.

5.2.40. A CCP should also recalibrate margin system parameters frequently and regularly to mitigate the potential risk that recalibration of margin system parameters results in a sudden jump in margin requirements. The predetermination of specific metrics referred to above (eg ex ante tolerances for acceptable large changes) can facilitate and enhance such an approach. In addition, a CCP should incorporate a historical period of high market volatility into its margin model so that the model can appropriately anticipate and mitigate suddenly destabilising reactions to risks associated with sudden increases in volatility.

5.2.41. The PFMI provide that a CCP should have the authority and operational capacity to make intraday margin calls and payments, both scheduled and unscheduled, to participants.⁹⁰ However, to increase appropriate responsiveness in margin systems, manual intervention and judgment in the recalibration of margin system parameters should take into account the CCP's holistic approach to procyclicality. While add-on charges may be a useful component in a CCP's margin system for the purposes of being most responsive to changing market conditions, a CCP should still seek to ensure that any application of such charges appropriately takes into account, to the extent practicable and prudent, the need to limit destabilising, procyclical changes in margin requirements and is otherwise consistent with the CCP's holistic approach to managing procyclicality (including any relevant internal governance or disclosure frameworks). For example, rather than relying on unscheduled and manual interventions, a CCP should consider using regular and automated margin calculations on an intraday basis. This is particularly important for unscheduled payment demands (eg for variation margin) that are difficult for participants to anticipate.

⁹⁰ See Key Consideration 4 of Principle 6 of the PFMI.

5.2.42. A CCP should consider the potential impact of its intraday variation margin collections and payments (especially where unscheduled) on the liquidity position of its participants.⁹¹ In addition, the PFMI also provide that transparency regarding market practices when market volatility increases may help mitigate the effects of procyclicality.⁹² A CCP should have in place pre-established policies and procedures for the application of margin charges that contemplate a specific governance process for collecting such amounts, particularly in instances when margin charges may apply in a manual or otherwise ad hoc manner. As an additional related measure, a CCP should also engage regularly with its participants and linked FMIs (and as appropriate, their customers) to better understand the potential impact, manual or otherwise, that unanticipated margin charges may have on the liquidity positions of those constituencies to facilitate a greater understanding ex ante by all involved parties of how margin charges may relate to procyclicality concerns (see also paragraphs 2.2.15 through 2.2.20).

Addressing procyclicality in other related areas

5.2.43. As noted above, a CCP should develop and implement an appropriate approach to procyclicality, where practicable and prudent, that is holistic and cuts across all aspects of its margin system, as well as other related aspects of its default management framework. Forward-looking and conservative collateral haircuts are a tool that a CCP should include among its available tools to manage procyclicality. The PFMI provide that, in order to reduce the need for procyclical adjustments, a CCP should also establish stable and conservative (collateral) haircuts that are calibrated to include periods of stressed market conditions, to the extent practicable and prudent.⁹³ For example, in a stressed market, a CCP may require the posting of additional collateral because of the decline of asset prices and an increase in haircut levels. Such actions could exacerbate market stress and help drive down asset prices further, resulting in additional collateral requirements.

5.2.44. In addition, a CCP should have procedures in place for monitoring macroeconomic and country-specific events such that its margin system can respond appropriately to any emerging risks while at the same time taking into account procyclical concerns. For example, a CCP could deploy a specified margin floor or targeted add-on charges. A CCP could also encourage or require participants to charge their clients margin above the level required by the CCP in order to assist in mitigating a large step change arising from a margin call.

Addressing specific wrong-way risk

5.2.45. A CCP should ensure that the risks addressed by its margin system explicitly include specific wrong-way risk. The PFMI defines specific wrong-way risk (SWWR) as a risk that arises where an exposure to a counterparty is highly likely to increase when the creditworthiness of that counterparty is deteriorating.⁹⁴ As a general matter, the PFMI provide that a CCP should identify and mitigate any credit exposure that may give rise to SWWR, as well as review its portfolio regularly in order to identify, monitor and mitigate promptly any exposures that give rise to SWWR. The challenge of identifying and seeking to address SWWR varies depending on the particular exposures a CCP may encounter in its clearing activities. As a general matter, a CCP should have clear rules, policies and procedures in place to identify assess and mitigate SWWR.⁹⁵

⁹¹ See paragraph 3.6.11 of the PFMI.

⁹² See paragraph 3.6.10 of the PFMI.

⁹³ See Key Consideration 3 of Principle 5 of the PFMI.

⁹⁴ See paragraph 3.6.9 of the PFMI.

⁹⁵ General wrong-way risk arises at a CCP when the potential losses of either a participant's portfolio or a participant's collateral is correlated with the default probability of that participant. Examples of general wrong-way risk include situations where the equity or debt securities issued by one participant could lose significant value if another similar participant defaults to the CCP, or when a sovereign default could be strongly correlated with the default probability of a participant domiciled in the same

5.2.46. In some instances, the risk of exposure to SWWR may be evident for certain cleared products. In the credit default swap context, SWWR may arise where a participant seeks to clear a product that references its own name or the name of an affiliate. Another related area where a CCP can be sensitive to exposures that may give rise to SWWR is the specific positions that participants or their customers may clear. As already discussed, this is an area where certain examples (ie clearing of products in the same name as a participant or customer) are well known. However, the ways in which a CCP may address SWWR in this context can vary depending on the circumstances. As a general matter, a CCP should have in place frameworks that identify, monitor and manage self-referencing or other highly correlated positions maintained by participants and their customers at the CCP. Such frameworks might include increased margin requirements for such positions, including through the application of add-on charges. Another potential approach could entail enhanced collateral requirements where, for example, the notional value of a cleared transaction that reflects a short position in the direct participant's equity or debt needs to be fully collateralised.

5.2.47. In addition to concerns over how positions cleared at a CCP may give rise to SWWR, a CCP should also keep in mind how other aspects of its operations affect risk exposure. For example, all CCPs collect collateral from their participants based on specific margin system requirements and methodologies. In this context, a CCP should consider whether the type of collateral it accepts or other aspects of its margin systems create exposures to SWWR, and should use suitable, sufficient and transparent methods to identify risks arising from the interconnection between the creditworthiness of participants (and customers, as applicable) and respective risk exposures. For example, a CCP could incorporate SWWR into its collateral acceptance policy through the imposition of collateral limits or constraints to mitigate SWWR, to the extent practicable. In addition, a CCP could prevent participants or their customers, as appropriate, from posting collateral where there is a correlation between the creditworthiness of a participant (or customer) and the value of the collateral it has posted to the CCP. Another potential approach could entail a CCP imposing limits on collateral eligibility for certain securities based on average daily trading volume of such securities.

Portfolio margining

5.2.48. A CCP that uses portfolio margining should identify and apply clear criteria when determining what products are correlated and, therefore, potentially eligible for portfolio margining, including criteria to evaluate whether portfolios may be reliably liquidated and risk-managed in the event of a participant default. Such a CCP should also continuously review and monitor the performance of its portfolio margining system in order to ensure that the margin system of the CCP performs appropriately under both current market conditions and during periods of market volatility.

In addition to the considerations discussed immediately above, a CCP should also evaluate and determine whether portfolio margined positions can be reliably liquidated in the event of a participant's default over a range of market conditions. A CCP should factor into its conclusions regarding correlation of products specific assumptions regarding how those correlations perform when the portfolio has to be liquidated in a stressed market environment.

5.2.49. The PFMI provide that, in calculating margin requirements, a CCP may allow offsets or reductions in required margin across products that it clears, if the risk of one product is significantly and reliably correlated with the risk of the other product.⁹⁶ In this regard, the PFMI specifies a number of elements for a CCP to consider and apply. These elements include: (i) an economically meaningful methodology that reflects the degree of price dependence between products; (ii) ensuring that the resultant offset or reduced margin requirements continue to meet or exceed the single-tailed confidence level of at least 99% with

country. Consistent with Principles 4 and 6, a CCP should cover its potential futures exposures to general wrong-way risk when calculating its margin requirements.

⁹⁶ See Key Consideration 5 of Principle 6 of the PFMI.

respect to the estimated distribution of the future exposure of the portfolio; (iii) continuous review and testing of offsets among products; and (iv) testing the robustness of its portfolio method on both actual and appropriate hypothetical portfolios, with a particular focus on testing how correlations perform during periods of actual and simulated market stress to assess whether the correlations break down or otherwise behave erratically. Prudent assumptions informed by these tests should be made about product offsets.⁹⁷

Reliable statistical relationship

5.2.50. A CCP should identify and apply clear criteria when determining what products are correlated and therefore potentially eligible for portfolio margining. In this respect, a CCP should determine (i) whether a strong economic rationale exists (eg the products are complements of or substitutes for each other, or one product serves as a significant input into the other product); (ii) whether a proven ability to risk-manage the products as a single portfolio already exists; and (iii) whether a reliable joint statistical relationship between the products in the portfolio exists. For example, in determining whether a strong economic rationale exists, a CCP could look to the similarity of product characteristics and features and the extent to which assets underlying those products overlap; this analysis could complement any price correlation observed between products.

5.2.51. While no specific approach or model for correlations is endorsed in the PFMI, as a general rule a CCP should identify and consider different aspects of correlation across products. For instance, stability of correlation is an important element and can be understood to mean stability of cross-product correlation and how changes in correlation are captured by the CCP's margin system. Under this approach, a CCP could apply portfolio margining to two products when price changes in the respective products exhibit a stable correlation over time. Another consideration in determining the appropriate margin for a portfolio is the level of correlation between two products, although it is not necessarily the case that lower correlations imply less likelihood that portfolio margining is prudent. In seeking to apply and understand these different but complementary aspects of correlation, a CCP should consider applying certain thresholds on the level and stability of correlation that must be met as well as minimum thresholds regarding the period of time over which each historical correlation is measured, the sample period over which historical correlation data are together, and the confidence level. When thresholds are used, they should be applied in a manner that reflects the ability of the CCP's margin model to capture changes in correlation between products.

5.2.52. In seeking to implement its approach to identifying and addressing correlation, a CCP should have in place specific measures that address a variety of instances of correlation. For example, a CCP could seek to address instances when there are price differences between two contracts within the same product type through the application of hypothetical stress or correlation scenarios as well as apply multiple correlation parameters (eg Pearson, Kendall's tau, Spearman etc). In any event, a CCP should ensure that it applies suitable and sufficiently prudent methods to identify and measure both present and future exposure at both the individual product and combined portfolio levels. As discussed below, specific consideration of default and other stressed scenarios can be useful in this regard.

Monitoring of the portfolio margining system

5.2.53. A CCP should monitor the performance of its portfolio margining system on an ongoing basis to ensure that the margin system of the CCP performs appropriately under both current market conditions and during periods of market volatility. Such monitoring includes, for example, a CCP reviewing the performance of the portfolio margin model during periods of market volatility, assessing the assumptions regarding the robustness of the dependence among products, and observing how those offsets and assumptions impact the overall performance of the CCP's margin system. For example, sensitivity analysis could be performed on the set of correlations used for the offsets and the results could then be considered in connection with the CCP's wider consideration of its sensitivity analysis of the margin system.

⁹⁷ See paragraph 3.6.12 of the PFMI.

5.2.54. In considering these matters, a CCP should maintain strong internal controls on the extent and practice of its portfolio margining. In addition, a CCP should review the appropriateness of portfolio margining treatment regularly and should include in its review an assessment of the economic rationale. A CCP should also implement and maintain controls and procedures that allow its risk management process to override any offsetting of products that, despite a high level of correlation, may not reflect a prudent degree of stability of correlation. For this purpose, a CCP should explicitly consider how its approach to procyclicality relates to such controls and procedures.

6. CCP contributions to losses

6.1 Context

6.1.1. Principles 4 and 15 of the PFMI require a CCP to maintain financial resources to cover losses resulting from a participant default and general business risk, including custody and investment risk, respectively. The financial resources used to cover such losses may come from participants or the CCP itself, as specified by the CCP's rules. As participants are expected to contribute resources towards certain losses and entrust assets to the CCP for safeguarding, a CCP's contribution of its own resources to losses resulting from a participant default and the custody and investment of participant assets can improve confidence that the legitimate interests of participants and other relevant stakeholders are reflected in the CCP's risk management as expected under Key Consideration 7 of Principle 2.⁹⁸ This guidance is intended to provide further direction for a CCP when contributing its own resources toward these types of loss.

6.2 Guidance

6.2.1. In carrying out the responsibilities outlined in Key Consideration 7 of Principle 2, a CCP should determine and expose an amount of its own financial resources to absorb losses resulting from a participant default and the custody and investment of participant assets⁹⁹ that would enhance confidence that the CCP's design, rules, overall strategy and major decisions reflect appropriately the legitimate interests of its participants and other relevant stakeholders.¹⁰⁰ In particular, the amount and characteristics (eg form, composition, segregation and seniority in a loss "waterfall") of a CCP's own contribution to absorb potential losses resulting from a participant default and the custody and investment of participant assets can enhance confidence among the participants with respect to the risk management at the CCP and with respect to the alignment of the incentives between the CCP and its participants. In determining the amount and characteristics, the CCP should consider the results of engagement with direct and indirect participants and other relevant stakeholders. Further, to achieve these objectives, a CCP should identify the amount of its own financial resources to be applied prior to those of non-defaulting participants to absorb losses resulting from a participant default and prior to those of all participants to absorb losses resulting from the custody and investment of participant assets.

Losses related to a participant's default

6.2.2. A CCP typically uses a sequence of prefunded financial resources to manage its losses caused by a participant default. These prefunded financial resources are commonly referred to as a "waterfall" and may include the defaulter's initial margin, the defaulter's contribution to a prefunded default arrangement, a specified portion of the CCP's own funds, and other participants' contributions to a prefunded default arrangement.¹⁰¹ When a CCP contributes a portion of its own resources to losses resulting from a participant default, these contributions can help to enhance participants' confidence in a CCP's management of risk since the CCP's own resources are exposed to some portion of the loss. A CCP,

⁹⁸ For the purposes of this guidance, references to "losses" collectively mean losses resulting from a participant default and the custody and investment of participant assets unless otherwise specified.

⁹⁹ In some CCPs, participants have full decision-making authority with regard to the custody and investment of their assets, including any margin and default fund posted by the participant to the CCP. In these instances, the associated custody and investment risks will depend on the decisions made by the participant and not the CCP. Accordingly, where the client has full decision-making authority for the safeguarding of participant assets, the CCP would not be expected to identify an amount of its own resources to apply toward losses arising from those custody and investment risks. If a CCP operates multiple clearing services that apply different models for safeguarding participant assets, the exception noted here would only apply to those service lines for which the CCP does not have full decision-making authority on how assets are held and invested.

¹⁰⁰ See also paragraphs 2.2.9 and 2.2.10 of Section 2.

¹⁰¹ See paragraph 2.2.9 of Section 2.

therefore, should identify the amount of its own financial resources to be applied towards losses resulting from a participant default; this amount may be in excess of any minimum amount required by law.¹⁰²

Custody and investment losses

6.2.3. A CCP is responsible for safeguarding the assets that its participants provide to the CCP and for minimising any risk of loss or delay in access to these assets.¹⁰³ Typically, a CCP will hold participants' assets (cash and securities) with custodians selected by the CCP and may invest these assets, in accordance with its investment policy. In order to minimise the associated risks, a CCP is expected to use supervised and regulated custodians, and any invested assets should be in instruments with minimal credit, market and liquidity risks.¹⁰⁴ Despite these risk controls, participants could be exposed to potential losses that they are not in a position to manage or mitigate fully because the CCP has discretion over custody and investment decisions. Consequently, a CCP should identify the amount of its own resources to be applied towards losses arising from the custody and investment risk, to bolster confidence that participants' assets are prudently safeguarded.

Seniority of the CCP's own financial resources

6.2.4. Participants' and stakeholders' confidence in the CCP's risk management practices may depend, in part, on where the CCP positions its own resources to losses vis-à-vis contributions from its participants. Applying a CCP's resources prior to those of non-defaulting participants in a participant default scenario and all participants in the event of losses due to the custody and investment of participant assets ensures that the CCP is among the first to bear losses and thus may increase confidence in risk management at the CCP among its participants. Therefore, a CCP should apply the amount of its own resources determined necessary to enhance participant confidence prior to those of non-defaulting participants to absorb potential losses resulting from a participant default and prior to those of all participants to absorb losses resulting from the custody and investment of participant assets. In addition to this amount, a CCP may also choose to expose a separate amount of its own resources to remaining losses concurrently or after allocating a portion of such losses to its participants.

Form of a CCP's own resources exposed to losses

6.2.5. An FMI's default rules and procedures should enable the FMI to take timely action to contain losses and promptly use any financial resources that it maintains to cover losses resulting from a participant default.¹⁰⁵ In order to achieve this outcome, any of a CCP's own financial resources exposed to losses resulting from a participant default as part of the waterfall should be of high quality and sufficiently liquid, such as cash, cash equivalents or liquid securities, to ensure that they can be used promptly and effectively in the event of a participant default, consistent with the expectations set forth in Principle 4 of the PFMI. In particular, a CCP would be expected to have rules and procedures on how it would replenish any of its financial resources that it may employ during a participant default.¹⁰⁶ Furthermore, a CCP should ensure that any financial resources it contributes to its "waterfall" are only available for this purpose and cannot be applied to any other type of loss.¹⁰⁷

6.2.6. As set out in Principle 15, a CCP is expected to hold sufficient liquid net assets funded by equity to cover potential losses associated with its general business risk so that it can continue its operations and

¹⁰² See paragraph 2.2.9 and 2.2.10 of Section 2.

¹⁰³ See Principle 16 of the PFMI.

¹⁰⁴ See Key Consideration 1 of Principle 16 of the PFMI.

¹⁰⁵ See paragraph 3.13.3 of the PFMI.

¹⁰⁶ See Key Consideration 7 of Principle 4 of the PFMI.

¹⁰⁷ See also paragraph 3.4.24 of the PFMI.

services as a going concern.¹⁰⁸ Custody and investment risk is considered a type of general business risk and business-related losses may arise from custody and investment risk.¹⁰⁹ Nevertheless a CCP should ensure that any financial resources it contributes to absorb potential losses resulting from the custody and the investment of participants' assets are only available for this purpose and cannot be applied to any other type of loss; therefore the amount of these resources should not be counted towards the amount of liquid net assets funded by equity required under Principle 15 of the PFMI.

6.2.7. Where a CCP exposes some amount of its financial resources to custody and investment losses, those assets should be of high quality and sufficiently liquid, such as cash, cash equivalents, or liquid securities, to ensure that they are readily available for use when needed.¹¹⁰ Furthermore, assets held by a CCP to cover losses other than general business risk or to cover losses from other business lines that are unrelated to its activities as a CCP should not be included when accounting for liquid net assets available to cover general business risk, including custody and investment risk.¹¹¹ When developing its capital plan, a CCP should take into account any liquid net assets funded by equity that it expects to apply towards potential business risk materialisation, including custody and investment losses; the CCP should also specify how it would raise new capital if were to use these assets to cover such losses.¹¹²

¹⁰⁸ See Principle 15 of the PFMI.

¹⁰⁹ See paragraph 3.15.1 of the PFMI.

¹¹⁰ See paragraph 3.15.8 of the PFMI.

¹¹¹ See paragraph 3.15.7 of the PFMI.

¹¹² See paragraph 3.15.9 of the PFMI.

7. Recovery

7.1 Context

7.1.1. Principle 3 of the PFMI requires FMIs, including CCPs, to have sound risk management frameworks in place that comprehensively manage the various types of risk that a CCP might face, including legal, credit, liquidity, operational and other risks. The realisation of such risks has the potential to result in a CCP's financial failure. In order to avoid such a result, Principle 3 of the PFMI requires a CCP to "identify scenarios that may potentially prevent it from being able to provide its critical operations and services as a going concern and assess the effectiveness of a full range of options for recovery or orderly wind-down. [It] should prepare appropriate plans for its recovery or orderly wind-down based on the results of that assessment".¹¹³ To support the planning process, in October 2014, CPMI-IOSCO published a report on *Recovery of financial market infrastructures* (Recovery Report) to provide guidance to FMIs in developing comprehensive and effective recovery plans.¹¹⁴

7.1.2. A CCP's ability to recover its viability and financial strength following a stress event is critical to financial stability. It is therefore imperative that each CCP subject to the PFMI has a recovery plan in place, including any rules and procedures necessary for the CCP to operationalise its plan, and that the plan is consistent with the PFMI and the guidance in the Recovery Report.

7.1.3. The guidance in this section reiterates certain aspects of recovery guidance previously published by CPMI-IOSCO in the Recovery Report. It is intended to facilitate a CCP's development of its recovery plan in a number of areas. Specifically, a CCP's recovery plan should include tools that comprehensively and effectively address, among other things, (i) the allocation of losses not caused by participant default; (ii) the allocation of uncovered credit losses and liquidity shortfalls; (iii) the speed of replenishment of depleted financial resources; and (iv) the re-establishment of a matched book following a participant default. In addition, as stated in the Recovery Report, a CCP should test and review its recovery plan.

7.2 Guidance

Allocation of losses not caused by participant default

7.2.1. A CCP will need to be able to recover from an extraordinary one-off loss or recurring losses from general business, custody, and investment risks.¹¹⁵ As stated in the Recovery Report, a CCP "should have comprehensive arrangements in place to allocate losses from the custody and investment risks it incurs as a result of its clearing and settlement activity – for example, risks arising from investment of participants' cash margins, from participants' funds held at payment or settlement banks, or from participants' assets held in custody".¹¹⁶

7.2.2. The Recovery Report also states that a CCP must have sufficient capital to enable it to absorb general business losses, and that allocation of such losses should begin with the premise that the losses are first charged against the CCP's capital, ie they should be borne in the first instance by the owners of the CCP.¹¹⁷ The CCP should have sufficient capital to cover such losses and, even where capital is sufficient, the CCP will need to replenish it after it has been used. A CCP should therefore have a viable plan to

¹¹³ See Key Consideration 4 of Principle 3 of the PFMI. See also Key Consideration 7 of Principle 2, Key Consideration 7 of Principle 4, and Key Consideration 10 of Principle 7 of the PFMI.

¹¹⁴ The guidance in the Recovery Report was directed to all FMIs. In this report, which is focused on CCPs, references to the guidance in the Recovery Report refers only to CCPs.

¹¹⁵ See paragraph 4.6.1 of the Recovery Report.

¹¹⁶ See paragraph 4.6.2 of the Recovery Report.

¹¹⁷ See paragraph 4.6.3 of the Recovery Report.

increase its capital and meet its capital requirements.¹¹⁸ For example, a CCP's plan may involve recapitalisation after extraordinary losses, capital conservation measures such as suspension of dividends and payments of variable remuneration, or voluntary restructuring of liabilities through debt to-equity conversion in order to raise capital and meet its capital requirements.¹¹⁹

Full allocation of uncovered credit losses and liquidity shortfalls following participant defaults

7.2.3. The Recovery Report provides guidance on the expectations in Principles 4 and 7 regarding the allocation of any uncovered credit losses and liquidity shortfalls following any individual or combined default among its participants with respect to any of their obligations to the CCP. A CCP should have rules and procedures to address how such credit losses and liquidity shortfalls would be fully allocated. The Recovery Report sets forth a number of considerations for allocating losses and liquidity shortfalls.¹²⁰ It notes that there may be benefits to distributing losses or liquidity shortfalls as widely as possible so as to minimise the amount that each entity would have to bear individually,¹²¹ and, conversely, that there may also be benefits to allocating losses or liquidity shortfalls to those who have assumed roles that are consistent with absorbing such losses and liquidity shortfalls (mutualisation of losses and liquidity shortfalls among direct participants in the case of participant default is based on this approach).¹²² The Recovery Report also discusses the possibility that, where direct participants are exposed to losses or liquidity shortfalls related to activities they conduct on behalf of indirect participants, those indirect participants may be indirectly exposed as specified in ex ante contracts with the relevant direct participant.¹²³

7.2.4. Although a CCP must meet the minimum liquidity requirements set out in Principle 7 of the PFMI using qualifying liquid resources in all relevant currencies such that it can effect same-day and, where appropriate, intraday and multi-day settlement of payment obligations in extreme but plausible market conditions, and a CCP may have supplementary liquidity to help bolster its liquidity resources in certain scenarios, uncovered liquidity shortfalls may crystallise in extreme circumstances and liquidity tools are needed to address this risk.¹²⁴ To address uncovered liquidity shortfalls, the Recovery Report provides that "[t]he most reliable forms of liquidity are likely to be cash and pre-arranged and highly reliable funding arrangements that qualify as liquid resources for meeting minimum requirements under Principle 7. In designing its recovery plan for extreme scenarios, however, an FMI will need additional tools to obtain liquidity from third-party institutions, its participants, or both."¹²⁵ Sizing liquid resources for extreme but plausible conditions and taking steps to detect and address liquidity shortages at an early stage is not sufficient; a CCP should also include in its recovery plan a clear description of its arrangements for obtaining additional liquidity resources when required.

Speed of replenishment of financial resources

7.2.5. Principles 4 and 7 of the PFMI require that a CCP should have rules and procedures to replenish any financial resources it may employ in a stress event so that it can continue to operate in a safe and

¹¹⁸ See paragraph 4.6.4 of the Recovery Report.

¹¹⁹ See paragraph 4.6.4 of the Recovery Report.

¹²⁰ See paragraphs 3.4.1 through 3.4.7 of the Recovery Report

¹²¹ See paragraph 3.4.2 of the Recovery Report.

¹²² See paragraph 3.4.3 of the Recovery Report. The Recovery Report also notes that in many FMIs, losses due to participant default are allocated to the owners of the FMI as an early part of the default waterfall. See paragraph 3.4.3 of the Recovery Report; see also Section 6.

¹²³ See paragraph 3.4.5 of the Recovery Report.

¹²⁴ See paragraph 4.3.1 of the Recovery Report.

¹²⁵ See paragraph 4.3.1 of the Recovery Report.

sound manner.¹²⁶ As described in the Recovery Report, a CCP “should have the capacity to replenish promptly any depleted financial resources needed to meet the minimum financial requirements under the PFMI. At the same time, market conditions or financial stability concerns at the time of a stress event might warrant a more measured pace for replenishment. In recognition of this potentially unavoidable trade-off, [a CCP’s] rules and procedures should avoid automatic triggers but provide it with the capacity to effect a replenishment as soon as practicable, including by the following business day when that would be the case, along with the capacity and responsibility to determine the most appropriate pace for replenishment in the light of prevailing circumstances”.¹²⁷ This means that a CCP bears the burden of proof to demonstrate why it would be impracticable to replenish its resources by the following business day.

7.2.6. As further noted in the Recovery Report, “[i]n order to replenish its resources, [a CCP] may either collect resources from its participants by means of cash calls ([ie] ex ante assessment rights . . .) and/or raise additional equity capital It may therefore be that [a CCP] relies on assessment rights both to meet uncovered losses and to replenish depleted resources. Where assessment rights are capped, [a CCP] could consider whether a portion of the assessment rights should be reserved for replenishment and, correspondingly, if it should make greater use of other tools to cover defaults.”¹²⁸

Re-establishing a matched book

7.2.7. Returning to a matched book of obligations is essential to the recovery of a CCP following a participant default. There are a number of voluntary and mandatory tools a CCP may use in order to re-establish a matched book, which are discussed in more detail in the Recovery Report. To avoid the need to resort to mandatory tools such as forced allocation or tear-up of contracts, however, the Recovery Report states that “the CCP should maximise the chances of a successful voluntary approach through appropriate use of the tools described in previous sections, such as assessment rights that would provide sufficient additional resources over and above its prefunded default resources which it can draw on to fund a market-based sale, auction, or buy-in. A CCP should also consider establishing ex ante incentives for direct participants to support and to participate in any market-based sale, auction or buy in, for example by establishing rules that would first allocate losses to participants that are not successful bidders in such voluntary approaches (e.g., by ‘juniorising’ – or using first – the mutualised default fund contributions of such participants).”¹²⁹ Complete tear-up is considered equivalent in its effect to a closure or wind down of the CCP, albeit in a manner which would allow a restart should participants wish. Use of complete tear-up should be avoided to the extent practicable, and the use or imminent use of such a tool may be a trigger for resolution.¹³⁰

Testing of recovery plans

7.2.8. In addition to developing recovery plans, the CCP should test and review all aspects of its recovery plan, to help ensure that the recovery plan can be implemented effectively, for example by carrying out periodic simulation and scenario exercises. As further described in the Recovery Report, such testing and review should occur at least annually as well as following changes to the CCP’s planning, rules, procedures or services that would materially affect the recovery plan. A CCP may choose to conduct this testing and review, to the extent practicable, as part of its annual testing and review of its participant default rules and

¹²⁶ Key Consideration 7 of Principle 4 and Key Consideration 10 of Principle 7 of the PFMI.

¹²⁷ See paragraph 4.4.1 of the Recovery Report.

¹²⁸ See paragraph 4.4.3 of the Recovery Report.

¹²⁹ See paragraph 4.5.3 of the Recovery Report.

¹³⁰ See paragraph 4.5.16 of the Recovery Report.

procedures, in accordance with Principle 13 of the PFMI. The CCP should update its recovery plan as needed following the completion of each test and review.¹³¹

¹³¹ See paragraph 2.3.8 of the Recovery Report.

8. List of PSG members

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