LCH Limited

CPMI – IOSCO Self Assessment 2017

Assessor	In 2017, LCH Limited (LCH) performed a self-assessment of its observance with the CPMI-IOSCO Principles for Financial Market Infrastructures (PFMIs).
Objective of the assessment	LCH's self-assessment was undertaken in accordance with the PFMIs of April 2012 and to demonstrate compliance with them.
Scope of the assessment	This self-assessment was made against all PFMIs which apply to CCPs and covers all the clearing services of LCH.
Methodology of the assessment	LCH followed the disclosure framework and applied the assessment methodology recommended by CPMI-IOSCO.
Source of information in the assessment	In making this assessment, LCH used a combination of public and non-public information, including LCH's policies, procedures and management information. This was also supplemented with discussions with LCH staff responsible for critical activities of the central counterparty.
Date of assessment	LCH's assessment was made using data available as of 31st March 2017.

LCH The Markets' Partner

Contents

1 Executive Summary 3
2 Overview of LCH 4
3 Detailed assessment report 6
Principle 1: Legal basis 6
Principle 2: Governance 9
Principle 3: Management of risks 15
Principle 4: Credit Risk 19
Principle 5: Collateral 26
Principle 6: Margin 29
Principle 7: Liquidity risk 36
Principle 8: Settlement Finality 41
Principle 9: Money Settlements 43
Principle 10: Physical deliveries 46
Principle 13: Participant-default rules and procedures 49
Principle 14: Segregation and portability 53
Principle 15: General business risk 56
Principle 16: Custody and investment risks 58
Principle 17: Operational risk 60
Principle 18: Access and participation requirements 64
Principle 19: Tiered participation arrangements 68
Principle 20: FMI links 70
Principle 21: Efficiency and effectiveness 73
Principle 22: Communication procedures and standards 75
Principle 23: Disclosure of rules, key procedures, and market data 76
Appendix: Key terms and abbreviations 80

1 Executive Summary

LCH has completed a self-assessment against the 24 Principles for Financial Market Infrastructures (PFMIs), as published by the Committee on Payment and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO)[1]. The self assessment was completed using the recommended assessment methodology published by CPMI and IOSCO[2].

[1] http://www.bis.org/publ/cpss101a.pdf
[2] http://www.bis.org/publ/cpss106.pdf

LCH The Markets' Partner

2 Overview of LCH

LCH is a central counterparty incorporated in the United Kingdom serving major international exchanges and platforms, as well as a range of over-the-counter (OTC) markets. In its role as a central counterparty LCH assumes counterparty risk between trading counterparties by becoming the legal counterparty to the trade and ensuring the financial performance of the trade.

In clearing a trade, LCH becomes counterparty to, and responsible for, trade obligations to clearing members. This principle is known as novation or registration. LCH does not in its normal course of business assume market risk in respect of the trades that it clears.

LCH clears a broad range of asset classes, including securities, exchange-traded derivatives, commodities[3], interest rate swaps, inflation swaps, non-deliverable FX forwards, bonds, and bond repurchase transactions, and works closely with market participants and exchanges to identify and develop clearing services for new asset classes.

On 31st March 2017, LCH had 156 clearing members, consisting of banks, securities houses, investment banks, commodity brokers and traders.

LCH is a Recognised Clearing House (RCH) in the UK under the Financial Services and Markets Act 2000 (FSMA) and, as such, is approved by the Bank of England to clear a diverse range of asset classes.

As a CCP established in the United Kingdom, LCH is required to comply with the European Market Infrastructure Regulation (EMIR) along with the related Regulatory Technical Standards (RTS). LCH is authorised in accordance with Article 17 of EMIR.

LCH is designated under the UK Financial Markets and Insolvency (Settlement Finality) Regulations 1999, which implemented Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems (the Settlement Finality Directive).

LCH is registered by the Commodity Futures Trading Commission (CFTC) as a Derivatives Clearing Organization (DCO), to provide clearing services as part of the SwapClear and ForexClear services in the USA, and futures and options contracts traded on or subject to the rules of a Designated Contract Market.

LCH is licensed by the Swiss Financial Market Supervisory Authority (FINMA), to operate a securities settlement system in the role of central counterparty to SIX Swiss Exchange as part of the EquityClear service.

LCH is designated as a systemically important central counterparty for the Swiss financial system by the Swiss National Bank.

LCH is recognised by the Ontario Securities Commission (OSC), Canada, pursuant to Section 21.2 of The Securities Act, R.S.O 1990, to provide the EnClear, ForexClear, RepoClear and SwapClear clearing services in Ontario.

LCH is recognised by the Autorité des Marchés Financiers (AMF, Québec), Canada, pursuant to Section 12 of the Derivatives Act, CQLR to provide the ForexClear, RepoClear and SwapClear clearing services in Québec.

The SwapClear service is designated as systemically important by the Bank of Canada.

LCH is licensed by the Australian Government to provide the SwapClear service in Australia.

LCH is licensed by Finanstilsynet (Norway) and the Norwegian Ministry of Finance to provide clearing services in respect of Oslo Børs as part of the EquityClear service.

LCH is recognised by the Monetary Authority of Singapore to provide the CommodityClear (previous EnClear) (Freight Division), ForexClear and SwapClear services in Singapore.

[3] LCH announced on 30th June 2017 that it would cease clearing commodity derivatives by 29th December 2017

Subsequent to the date of this self-assessment, LCH was licensed by the Japanese Financial Services Agency to provide the SwapClear service (excluding Yen products) in Japan.

LCH offers clearing, for the products noted above through its clearing services as set out below:

LCH's SwapClear service clears interest rate swaps, forward rate agreements, overnight index swaps and variable notional swaps products in 17 currencies, as well as inflation swaps in three currencies..

LCH's RepoClear service clears cash bond and repo trades in the following markets: Austrian, Belgian, Dutch, German, Irish, Finnish, Portuguese, Slovakian, Slovenian, Spanish and UK government bonds; German Jumbo Pfandbriefe and select Agency, Supranational, Regional and Explicitly Government Guaranteed Bonds.

LCH's EquityClear service clears equities, equity equivalents such as exchange traded funds (ETFs), exchange traded commodities (ETCs), real estate investment trusts (REITS) and contracts for difference (CFDs). LCH clears these products for participants of BATS Chi-X Europe, Burgundy, Equiduct, London Stock Exchange, Oslo Børs, SIX Swiss Exchange, Turquoise, Aquis Exchange and OTC venues. As part of the EquityClear service LCH has entered into interoperable arrangements with other CCPs; such arrangements have been approved by the appropriate national competent authorities.

LCH's ForexClear service clears non-deliverable forwards (NDFs) in 12 currency pairs.

LCH's CommodityClear service (previously EnClear) clears OTC derivatives in commodities such as coal, fertilizer, iron ore, and steel; container freight, forward freight agreements, and emissions.

LCH also clears listed financial derivatives for London Stock Exchange Derivatives Market (LSEDM) Nasdaq NLX[4] and CurveGlobal (an interest rate derivatives platform that offers trading and clearing of futures and OTC products for the full range of both short-term interest rate (STIRs) and long-term interest rate (LTIRs) euro-and sterling-based listed derivatives)..

[4] As of 28th April 2017, Nasdaq NLX ceased operation and all positions were closed or transferred to CurveGlobal

3 Detailed assessment report

Principle 1: Legal basis

An FMI should have a well-founded, clear, transparent, and enforceable legal basis for each material aspect of its activities in all relevant jurisdictions.

The LCH Rulebook covers all material aspects of LCH's activities and aims to provide a clear and certain legal basis for its operations, as well as the rights and obligations of both LCH and its clearing members. The enforceability of the LCH Rulebook, the Clearing Member Agreement and LCH's charges over member collateral is protected by UK legislation; and enforceability in other jurisdictions is underpinned by legal opinions from reputable external counsel based in those jurisdictions.

Key Consideration 1: The legal basis should provide a high degree of certainty for each material aspect of an FMI's activities in all relevant jurisdictions.

The material aspects, those which are fundamental to its safe operation as a CCP, of LCH's activities which require a high degree of legal certainty are:

- Settlement finality (see *Principle 8*)
- Default of clearing members (see *Principle 13*)
- Netting arrangements in the event of clearing member and client defaults and upon winding up of LCH
- Porting of client positions (see *Principle 14*) and
- Enforcement of collateral (see *Principle 5*)

Once LCH has accepted a trade for clearing it is unable to reject such a trade. LCH can amend the terms for which it accepts trades for clearing but this would need to happen prior to registration.

A high degree of legal certainty on these activities is achieved through obtaining legal opinions as to the enforceability of the Rulebook in all relevant jurisdictions (see *Key Consideration 5* and *Principle 16)*, performing due diligence, reviewing applicable legislation and procuring local legal advice.

The LCH Rulebook is governed by the laws of England and Wales and the LCH FCM Rulebook is governed by New York law. Each prospective clearing member must enter into a Clearing Membership Agreement with LCH; this requires the clearing member to comply with the terms of the relevant LCH Rulebook.

In order to ensure that the Rulebooks are enforceable in all jurisdictions in which services are offered, LCH obtains a legal opinion for each new jurisdiction from a reputable external counsel based in that jurisdiction before clearing members are admitted.

The Settlement Finality Regulations contained within the LCH Rulebook set out the conditions under which the settlement obligations in respect of registered exchange-traded contracts and OTC contracts are final and irrevocable. These regulations are supported by LCH's designation under the UK Financial Markets and Insolvency (Settlement Finality) Regulations 1999, which implemented Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems (the Settlement Finality Directive). Please see *Principle 8* for more details.

Key Consideration 2: An FMI should have rules, procedures, and contracts that are clear, understandable, and consistent with relevant laws and regulations.

LCH publishes the Rulebooks on its website. Clearing members are consulted ahead of the implementation of material rule changes.

The LCH Rulebooks and the procedures contained therein (the LCH Procedures) cover all material aspects of LCH's activities, and aim to provide a clear and certain legal basis for its operations and the rights and obligations of each of its clearing members. In order to ensure that the Rulebooks are enforceable in all jurisdictions in which services are offered, LCH obtains a legal opinion for each new jurisdiction from a reputable external counsel based in that jurisdiction before clearing members are admitted. The LCH Rulebooks are consistent with applicable law. Should any inconsistencies with applicable law arise, such as on implementation of a new regulation, LCH will remedy this through changes to its Rulebooks or operations. LCH monitors the release of new regulations or changes to current regulations through in-house specialist functions and third party providers.

LCH requires that changes to its Rulebooks are reviewed by its Rule Change Committee. Proposed changes are submitted, where required, to the Bank of England for approval or non-objection. Rulebook amendments are also subject to CFTC §40.6 self-certification procedures where necessary. They are also notified to other relevant regulators as necessary.

Key Consideration 3: An FMI should be able to articulate the legal basis for its activities to relevant authorities, participants, and, where relevant, participants' customers, in a clear and understandable way.

LCH's Articles of Association are available through Companies House, the UK company registrar. Key information related to the governance of LCH, including the composition and terms of reference of its Risk Committee, Audit Committee and Remuneration Committee are available on its website.

LCH publishes key information about its regulatory status on its website and in its annual report. The details of the relevant regulatory frameworks under which LCH operates, including statutory instruments and stated policies, are publicly available on the regulators' websites.

The LCH Rulebooks and the procedures contained therein (the LCH Procedures) cover all material aspects of LCH's activities, and aim to provide a clear and certain legal basis for its operations and the rights and obligations of each of its clearing members.

To ensure the basis for LCH's activities is known, LCH publishes the Rulebooks on its website. The Rulebooks refer to supporting legislative instruments where appropriate. LCH consults with its clearing members ahead of the implementation of material rule changes.

Key Consideration 4: An FMI should have rules, procedures, and contracts that are enforceable in all relevant jurisdictions. There should be a high degree of certainty that actions taken by the FMI under such rules and procedures will not be voided, reversed, or subject to stays.

In order to ensure that the Rulebooks are enforceable in all jurisdictions in which services are offered, LCH obtains, and publishes, a legal opinion for each new jurisdiction from a reputable external counsel based in that jurisdiction before clearing members are admitted.

There are no circumstances under which LCH's actions under its rules, procedures or contracts could be voided, reversed, or subject to stays.

No court in any jurisdiction has ever held any of LCH's relevant activities or arrangements under its rules and procedures to be unenforceable.

Key Consideration 5: An FMI conducting business in multiple jurisdictions should identify and mitigate the risks arising from any potential conflict of laws across jurisdictions.

LCH checks the adequacy of its legal framework for cross-border clearing members by obtaining legal advice regarding the enforceability of the Rulebook, the jurisdiction of English courts over non-UK domiciled clearing members, and the circumstances and extent to which an English law charge agreement will be enforceable under the laws of the jurisdiction. To date, LCH has obtained legal advice for Australia, Austria, Belgium, Canada (Ontario), Canada (Québec), Denmark, England and Wales, Finland, France, Germany, Hong Kong, Italy, Japan, the Netherlands, Norway, Poland, Portugal, Scotland, Spain, Sweden, Switzerland and the USA. LCH has a Legal Opinion policy which requires legal opinions be refreshed every three years or earlier if material changes occur to either the foreign jurisdiction or the Rulebook that could impact the outcome of the opinion.

LCH The Markets' Partner

In many cases, conflicts of law between jurisdictions do not arise. For European Members, LCH is a designated system under the Settlement Finality Regulations. For clearing members from other jurisdictions any action against LCH would need to be brought in an English Court where LCH is designated under the Settlement Finality Regulations and has the benefit of statutory protection in the form of Part VII of the Companies Act 1989.	
Publicly available resources	Rulebook Legal Opinions LCH Committee Terms of Reference Annual Report Regulatory licenses

LCH The Markets' Partner

Principle 2: Governance

An FMI should have governance arrangements that are clear and transparent, promote the safety and efficiency of the FMI, and support the stability of the broader financial system, other relevant public interest considerations, and the objectives of relevant stakeholders.

LCH operates under robust governance arrangements which provide an explicit responsibility and accountability structure. The LCH Board and its Committees have representation of both executive and non-executive individuals who are appropriately skilled personnel. The Chairman and the Chairs of the Board Risk, Remuneration and Audit Committees are among the independent non-executive directors. The LCH website publicly discloses the governance arrangements, including the ownership and organisational structure, composition of the Board and Board Committees, as well as Board and Committee terms of reference.

Key Consideration 1: An FMI should have objectives that place a high priority on the safety and efficiency of the FMI and explicitly support financial stability and other relevant public interest considerations.

LCH is a wholly-owned subsidiary of LCH Group Holdings Limited (LCH Group) a private company limited by shares, incorporated in the United Kingdom. LCH Group is 57.8 per cent owned by London Stock Exchange (C) Limited[5], a wholly-owned subsidiary of London Stock Exchange Group plc (LSEG), and 42.2 per cent owned by participants and exchanges.

The objectives of LCH are clearly identified and publicly available on the group's website. LCH's objectives are:

- To provide market leading risk management and clearing solutions.
- To manage our members' and clients' risk by providing effective and efficient clearing services.
- To promote a safe and stable financial market foremost in all that we do.

Furthermore, LCH is committed to safeguarding its members' interests and supporting general market and financial stability through its operations, including with respect to international and jurisdictional regulations regarding procyclicality.

Through regular business and risk management reviews, LCH assesses its performance against its objectives at both LCH Board and executive level. The LCH Board has adopted a Risk Governance Framework, setting out the risks facing LCH, its tolerance for these risks, the personnel with responsibility for each risk and has defined reporting requirements for each.

By including as an objective the reduction of risks and the safeguarding of the financial infrastructure in the markets it serves, LCH explicitly places a high priority on safety and efficiency as well as supporting financial stability in its public mission.

Key Consideration 2: An FMI should have documented governance arrangements that provide clear and direct lines of responsibility and accountability. These arrangements should be disclosed to owners, relevant authorities, participants, and, at a more general level, the public.

LCH operates under robust governance arrangements which provide a clear organisational structure, and set out the composition, role and responsibilities of the LCH Board and the LCH Board Committees.

The governance arrangements include CEO Executive Delegation, the ExCo Terms of Reference (TORs) and the Local Management Committee (LMC) TOR. These arrangements also set out the process for ensuring accountability to stakeholders.

LCH provides accountability to owners, participants and other relevant stakeholders by including user, clearing member and client representatives in governance forums. LCH's clearing services run Product

[5] In November 2017 London Stock Exchange Group increased its shareholding in LCH Group from 57.8% to 64.4%.

Advisory Groups and Risk Working Groups where participants are able to comment on proposed changes to markets, products and services, and to risk policies, models and frameworks. In addition, Clearing Members and Clients of Clearing Members are represented on the LCH Board Risk Committee where all material proposals are reviewed and recommended to the Board for approval.

LCH also adheres to a publicly available code of conduct, which sets out the minimum standards for engagement with stakeholders.

The governance arrangements of LCH are publicly available, including details of the LCH Board, the LCH Board committees' compositions and details of Executive delegation.

Key Consideration 3: The roles and responsibilities of an FMI's board of directors (or equivalent) should be clearly specified, and there should be documented procedures for its functioning, including procedures to identify, address, and manage member conflicts of interest. The board should review both is overall performance and the performance of its individual board members regularly.

The roles and responsibilities of the LCH Board are clearly specified through the company's Articles of Association and the LCH Board's Reserved Matters.

The LCH Board is responsible for the establishment of clear objectives and strategies, monitoring LCH's senior management, establishing appropriate remuneration policies, establishing and overseeing the risk management function, overseeing the compliance and internal control function, overseeing outsourcing arrangements and providing accountability to shareholders, employees, clearing members, clients and other stakeholders.

The LCH Board is comprised of 13 individuals: six independent non-executive directors (INEDs), one of whom is Chairman, four non-executive directors (of whom one is a LSEG director, one a representative of a venue, two representatives of clearing members) and three executive directors. As at 31 March 2017, there was a vacancy for one of the six INEDs and a representative of a venue.

The LCH Board has established an Audit Committee, Remuneration Committee and, as an advisory committee, a Risk Committee.

The composition of the LCH Board, Remuneration Committee, Audit Committee and Risk Committee are publicly available. The terms of reference for these committees are reviewed at least annually. Any changes arising from the annual review are reported to the relevant committee for recommendation to the Board which is then asked to approve the amendments.

The Remuneration Committee recommends, to the LCH Board, the broad remuneration policy and principles of LCH. Its responsibilities include:

- ensuring that the policy and principles are aligned with the company's risk tolerance and corporate strategy;
- reviewing that management and employees are provided with appropriate incentives to encourage focus on risk management as the core purpose of LCH; and
- reviewing that management and employees are, in a fair and responsible manner, rewarded for their individual contribution to the success of LCH.

The Remuneration Committee is comprised of four individuals: two INEDs, one of whom is the Chairman, a user representative and a LSEG director.

The Audit Committee represents the interests of the LCH Board in the sound financial management and internal control management of the company. Its responsibilities include:

- assisting the LCH Board in fulfilling its responsibilities to review audited financial statements;
- appointing external auditors;
- reviewing the internal audit function;
- reviewing regulatory compliance; and

- reviewing the operational risk framework and reviewing the internal control environment.

The Audit Committee is comprised of five individuals: three INEDs, one of whom is the Chairman, a user representative and an LSEG director.

The Risk Committee advises the LCH Board on the company's risk appetite, tolerance and strategy. Its responsibilities include:

- reviewing risk policies periodically;
- reviewing membership criteria and reviewing decisions with regards to LCH membership;
- considering risk controls designed or adapted for new contracts, product types or services; and
- considering proposals to make significant amendments to margin methodologies.

In all cases, following their review the Risk Committee will make recommendations based on their findings to the LCH Board for approval. In the event the Board decides not to follow the recommendation of the Risk Committee, the CCP is required to notify the competent authority within five days.

The Risk Committee is comprised of six individuals: two INEDs, one of whom is the Chairman, three representatives of clearing members and one representative of clients of clearing members. The metric for determining which clearing member and clients are members of the Committee is based on factors including the asset classes cleared, volume cleared, the level of contribution to the relevant default funds and whether they have previously been a voting member of the Committee. As at 31 March 2017, there was an INED vacancy on the Risk Committee.

The Articles of Association set out the obligations on LCH's Directors to disclose any potential conflicts of interest to other Directors, as well as the actions which may be taken to mitigate conflicts as they arise. The LCH Board of Directors performs an annual declaration of potential or actual conflicts of interest. At the beginning of each meeting of the LCH Board the agenda is reviewed by the Board Directors and actual or potential conflicts are considered for each agenda item. The tools available to the LCH Board to mitigate conflicts of interest include Directors recusing themselves from discussions. If there is any doubt whether a conflict exists, a determination will be made by the INEDs in conjunction with the Chief Compliance Officer, as to whether a conflict exists. The INEDs' decision is final.

As a measure of best practice, the LCH Board performs an annual review of its own performance and that of its Committees. The review includes consideration of the performance of LCH's Board members and the Chairman, and the LCH Board's behaviours and culture

Key Consideration 4: The board should contain suitable members with the appropriate skills and incentives to fulfil its multiple roles. This typically requires the inclusion of non-executive board member(s).

The LCH Board is comprised of 13 individuals (see key consideration 3 above for further details). The LCH Board takes the advice of the LCH Group Nomination Committee before approving changes in its size, structure and members. The Committee's Terms of Reference state that the Committee will need to ensure that its recommended candidates are respected for their competence and are of good standing in their field of business.

An LCH INED must be independent in character and judgement, and have no relationships or circumstances (including any with LSEG or any of its subsidiary undertakings and/or with any significant user or venue shareholder) which are likely to affect, or could appear to affect, his or her judgement. The identities of the INEDs are disclosed on the LCH website.

The independent members of the LCH Board receive a fee, which is fixed, and which is not linked to the business performance of LCH. Non-executive members of the LCH Board, other than the independent members, do not receive a fee. The non-executive members of the LCH Board represent the users of the CCP and in many cases the shareholders of LCH Group Limited.

It is a responsibility of the LCH Board, through its Reserved Matters, to perform adequate succession planning for the LCH Board, thereby ensuring the LCH Board continues to have appropriately skilled members.

Key Consideration 5: The roles and responsibilities of management should be clearly specified. An FMI's management should have the appropriate experience, a mix of skills, and the integrity necessary to discharge their responsibilities for the operation and risk management of the FMI.

LCH's senior management is responsible, in general, for ensuring consistency of LCH's activities with the LCH Board's objectives and strategy, establishing appropriate compliance and internal controls, subjecting internal controls to regular review and testing, ensuring sufficient resources are devoted to risk management and compliance, being actively involved in risk control processes and ensuring that risks posed to the CCP by its clearing and activities linked to clearing are duly addressed.

LCH's management team is made up of experienced professionals, taking responsibility for distinct areas of the operation, risk management and control of the CCP. In separating responsibilities, LCH has management in place with the necessary expertise for each area and maintains a mix of skills necessary for the operation and risk management of the CCP.

The roles and responsibilities of senior management are determined on the needs of LCH and set out in individual job descriptions. Once in role, LCH's senior management is subject to at least annual performance management reviews against their objectives and the core competencies identified as essential for all LCH employees. LCH is committed to ensuring that its reward practices promote sound and effective risk management and do not create incentives to relax risk standards. The annual performance review for members of the Executive Committee also includes assessments by the Group Chief Risk Officer against their respective risk objectives and by Group Head of Internal Audit in respective of internal audit reports and closure of internal audit actions. Both assessments are presented to the Remuneration Committee.

LCH monitors the performance of its senior management through regular reviews: in the case of non-performance, processes are in place to identify, escalate, remediate and ultimately reprimand and remove management if necessary.

Key Consideration 6: The board should establish a clear, documented risk-management framework that includes the FMI's risk-tolerance policy, assigns responsibilities and accountability for risk decisions, and addresses decision making in crises and emergencies. Governance arrangements should ensure that the risk-management and internal control functions have sufficient authority, independence, resources, and access to the board.

LCH's risk management is governed by the LCH Group Risk Governance Framework, adopted and reviewed annually by the LCH Board. This framework defines the universe of risks faced by LCH, the Board's tolerance for each risk, the standards which the Board expects LCH to meet in managing those risks, and, in addition, identifies the personnel with responsibility for each risk and sets reporting requirements. The Risk Governance Framework requires that a comprehensive risk policy framework is maintained which identifies how each risk is managed to those standards and within the Board's tolerance levels. The framework comprises a suite of risk policies, each of which is annually reviewed and approved by the LCH Risk Committee and LCH Board. The risk management function is responsible for putting the Risk Policy framework into practice and making reports to the Risk Committee.

The Chief Risk Officer reports directly to the Chief Executive Officer of LCH and makes independent reports to the LCH Risk Committee and LCH Board as necessary. The Chief Risk Officer is responsible for the management and control of risks within LCH pertaining to those risk types identified in the Risk Governance Framework. The Chief Risk Officer is supported by an effective team with the necessary authority, expertise, access and resource.

The Head of Internal Audit reports directly to the Chairman of the LCH Audit Committee. The Head of Internal Audit is responsible for providing objective and independent assurance to the Board of LCH on the effectiveness of risk management arrangements and activities across the company. The Head of

Internal Audit is supported by a team with the necessary access to material, independence from ongoing processes, authority and expertise.

The LCH Board ensures it has adequate governance surrounding the adoption and use of risk management models by setting policies and standards for the minimum level of review and governance steps which are required for margin models. The review steps culminate in evaluation by the LCH Risk Committee, which makes recommendations related to the models to the LCH Board.

New models and changes to existing margin models and related methodologies are reviewed through internal committees and external participant working groups as well as being subject to independent expert validation.

To manage a crisis or default, LCH has established a Crisis Management Team (CMT) and a Default Crisis Management Team (DCMT), each working across all of the LCH services. Each works within regularly reviewed plans and procedures ensuring that the response to and management of a crisis or default is well co-ordinated and effective, minimising the impact on employees and members.

Key Consideration 7: The board should ensure that the FMI's design, rules, overall strategy, and major decisions reflect appropriately the legitimate interests of its direct and indirect participants and other relevant stakeholders. Major decisions should be clearly disclosed to relevant stakeholders and, where there is a broad market impact, the public.

LCH discloses, on its website, detailed information on its operations and risk management, as well as information on the products it clears and associated fees. As and when these are amended the disclosures are updated and, where appropriate, circulars are distributed to members. Further to this, LCH routinely makes public announcements of changes in its Board Directors. LCH Group (the sole shareholder of LCH) holds General Meetings for its shareholders.

The LCH Board includes in its membership representatives of clearing members, venues and shareholders, thereby allowing these groups of stakeholders to be part of decision making on the design of services, rules, overall strategy and major decisions. Further to this, the LCH Risk Committee also includes in its membership representatives of clearing members and clients, thereby allowing these groups of stakeholders to be part of recommendations made to the LCH Board on risk matters. The executive Directors of the LCH Board and Committee members provide feedback from market participants, based on their day to day interaction, as part of these forums.

LCH has in place a number of tools available to it to seek feedback from its user community, including formal consultations and clearing member and client advisory forums and working groups.

At a working level, LCH engages with its clearing members and clients of clearing members in a range of advisory and risk working groups to support product development, upcoming changes and major decisions.

LCH complies with the LCH Group Conflicts of Interest Policy which sets out the methods for identifying and managing potential and actual conflicts of interest, including those between LCH and its stakeholders. LCH requires all its employees to declare, annually, any potential or actual conflicts of interest. A register of conflicts is held and updated on annual cycle by the Compliance department. Where a potential conflict may arise, specific conflicts of interest management procedures are applied. Actions LCH may take include applying "need to know" information barriers and ultimately disclosing any conflict which it could not sufficiently avoid or mitigate.

Publicly available resources	Objectives Code of Conduct LCH Board Composition LCH Committee Compositions

	LCH Committee Terms of Reference

Principle 3: Management of risks

An FMI should have a sound risk-management framework for comprehensively managing legal, credit, liquidity, operational, and other risks.

The LCH risk management framework reflects the LCH Board's risk appetite, and any amendments to this framework are subject to review and approval by the Board, to ascertain that such changes remain in alignment with the Board's risk tolerance. The risks identified within the framework and the risk management tools used to mitigate such risks are subject to ongoing and regular review, through a robust governance process. LCH maintains a recovery plan and a wind-down plan, which are reviewed annually by the Board.

Key Consideration 1: An FMI 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. Risk-management frameworks should be subject to periodic review.

LCH's overarching approach to risk management is administered according to the LCH Risk Governance Framework. This framework seeks to comprehensively identify the range of risks to which LCH is potentially exposed and to designate responsibility for these risks. Through the framework, the LCH Board defines tolerance levels for each category of risk and also sets guidelines for internal reporting to provide assurance that the framework is observed.

There are 22 risks defined within the Risk Governance Framework which has been mandated by the LCH Board:

- Latent market risk
- Sovereign risk (specific to clearing member positions)
- Wrong-way risk (specific to clearing member positions)
- Concentration risk (specific to clearing member positions)
- Counterparty credit risk
- Liquidity risk
- Procyclicality risk
- Settlement, payment and custody risk
- FX risk
- Business risk
- Operational risk
- Legal risk
- Regulatory and compliance risk
- Pension risk
- Project risk
- Business continuity risk
- Model risk
- Information security and cyber risk
- Investment risk
- Default management risk
- Strategic risk
- Reputational risk

The framework is given effect by targeted and detailed LCH risk policies which are managed by the LCH risk management function. Ownership of the risks and the control environment is defined in the policies, including the responsibility to maintain procedures in support of each relevant function.

The remaining risks, such as business continuity, legal risk, etc., are managed by dedicated business functions. The CRO is responsible for ensuring that an appropriate framework is in place to measure and monitor the status of each of the 22 risks against the Board's appetite, which is reported to the Board quarterly.

LCH operates systems which facilitate the accurate measurement and monitoring of risk exposures for all clearing services and associated functions, including margining, collateral and investment management, and credit risk management. These systems enable the aggregation of exposures across clearing services, counterparties and risk types.

The LCH Board ensures it has adequate governance surrounding the adoption and use of risk management models by setting policies and standards for the minimum level of review and governance steps that are required. The review steps culminate in evaluation by the LCH Risk Committee, which makes recommendations related to the models to the LCH Board.

New models and material changes to existing margin models and related methodologies are reviewed through internal committees as well as being subject to clearing member review and independent validation, in line with policies and standards.

The Risk Governance Framework specifies the LCH Board's standards and tolerance for each risk type; these underlie the principles and standards detailed in the risk policies. A set of performance indicators are used to monitor the effectiveness of the risk management framework. These indicators include backtesting of initial margins, 'cover 2' stress testing of clearing member exposures against default fund sizes, aggregate exposure measures, counterparty credit scores, liquidity ratios, interest rate risk analysis and operational risk assessments.

System performance is constantly monitored; methodologies for the calculation of key risk parameters, including margin levels, stress testing, collateral haircuts and liquidity management are independently reviewed at least annually, with a strict governance process in place for managing changes. The LCH Board reviews compliance with the framework on at least an annual basis. The Risk policies supporting the framework and the framework itself are also subject to review on at least an annual basis taking into account changes in market and regulatory environments.

Key Consideration 2: An FMI should provide incentives to participants and, where relevant, their customers to manage and contain the risks they pose to the FMI.

Since initial margin and default fund requirements are proportional to risk, each clearing member has an incentive to manage and contain the risks it poses to LCH in order to reduce their financial obligations. LCH's application of margin multipliers, which increase initial margin requirements with credit, liquidity, concentration and sovereign risks that exceed base assumptions, provides an additional incentive.

Policies and systems are designed to allow clearing members to manage and contain their risks by applying industry standard techniques where appropriate, which can be understood and replicated.

In the event that LCH's routine risk monitoring identifies instances in which a clearing member's portfolio sensitivity to price movements exceeds acceptable tolerances, LCH informs these clearing members and helps organise voluntary, mutually risk-reducing trades between clearing members.

Clearing members are provided with details of the margin and other default resource methodologies, in addition to a range of disclosures explaining LCH's risk management policies.

Key Consideration 3: An FMI should regularly review the material risks it bears from and poses to other entities (such as other FMIs, settlement banks, liquidity providers, and service providers) as a result of interdependencies and develop appropriate risk-management tools to

address these risks.

The LCH Risk Governance Framework contemplates risks posed by other entities. In particular, LCH seeks to manage risks posed by payment and settlement intermediaries (see *Principle 9*), custodians (see *Principle 16*), essential service providers (see *Principle 17*), and other FMIs (see *Principle 20*).

By managing risks posed to its solvency and orderly operation, LCH limits the risks that it poses to other entities and financial markets.

LCH conducts its money settlements in central bank money where possible; for all other money settlements LCH minimises and strictly controls the credit and liquidity risk arising. See *Principle 9* for further detail.

LCH safeguards its own and clearing members' assets and minimises the risk on and delay in access to these assets arising from its CSD and custodian arrangements. Investments are made in instruments with minimal credit, market and liquidity risks. See *Principle 16* for further detail.

See *Principle 17* on how LCH manages the operational risks that its providers might pose to its operations, and how LCH identifies, monitors and mitigates the operational risks LCH may pose to other entities.

The response to *Principle 20* describes how risks related to LCH's links with other FMIs are identified, monitored and managed.

The risk management tools that are used to address the risks arising from the interdependencies with other entities, and the measures to review the effectiveness of such tools, are described in the responses to *Principles 9, 16, 17* and *20*.

Key Consideration 4: An FMI should 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. An FMI should prepare appropriate plans for its recovery or orderly wind-down based on the results of that assessment. Where applicable, an FMI should also provide relevant authorities with the information needed for purposes of resolution planning.

In accordance with the recognition requirements for CCPs contained in Section 29B of the FSMA 2000 (Recognition Requirements Regulations) 2001, LCH maintains a Recovery Plan. The Plan sets out the steps that it will take in order to maintain the continuity of the services that it provides and the activities that it carries out that are specified in its recognition order in the event that such continuity is threatened. Additionally, as required by EMIR, LCH maintains a Wind Down Plan which describes the scenarios and events that may trigger the Wind Down Plan alongside the expected activities to wind down the clearing activities of LCH.

LCH operates a robust Risk Governance Framework, which has the objective of defining risk appetite, designating responsibilities for the measuring, monitoring and managing of risks and also providing guidelines for assurance activities associated with the framework. Through the execution of this framework, LCH identifies scenarios that may threaten its ability to continue to provide critical clearing services. In addition to the embedded risk framework in place, specific Recovery and Wind Down Planning exercises have taken place to document, for inclusion in the Plans themselves, high level scenarios that threaten LCH's ability to provide clearing services. Scenarios have been categorised into the following for the purposes of assessing the effectiveness of the recovery tools and to identify the actions required for the Wind Down Plan:

- Member default losses resulting in uncovered credit losses or liquidity shortfalls; and
- Non-default losses that threaten LCH's solvency, arising from general business risks, custody and investment risks and uncovered liquidity shortfall associated to these risks.

The Plans have been created with the objective of either continuity of critical services (Recovery Plan) or maintaining stability in financial markets by avoiding a disorderly failure of a CCP (Wind Down Plan). These objectives continue to be achieved by the comprehensive set of recovery tools available to LCH

and the relevant wind down procedural steps and associated ring-fenced capital required to enable execution of the Wind Down Plan. Reviews of both the Recovery and Wind Down Plans take place at least annually and where appropriate are aligned to existing annual market exercise regimes (e.g. annual fire drills) in order to simulate the implications of executing the Recovery and/or Wind Down Plans to ensure they remain relevant. Additionally, where the underlying business model of LCH is amended, the change framework in place ensures the implication of the change to the business model is considered with reference to the Recovery and Wind Down Plans and the necessary updates made. The LCH Board approves the Recovery and Wind Down Plans and is the final governance authority for updates to the Plans.	
Publicly available resources	Risk Management Overview Margin Methodologies Default Waterfall

Principle 4: Credit risk

An FMI should effectively measure, monitor, and manage its credit exposure to participants and those arising from its payment, clearing, and settlement processes. An FMI should maintain sufficient financial resources to cover its credit exposure to each participant fully with a high degree of confidence. In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that include, but not be limited to, the default of the two largest participants and their affiliates that would potentially cause the largest aggregate credit exposures to the CCP in extreme but plausible market conditions. All other CCPs should maintain, at a minimum, total financial resources sufficient to cover the default of the one participant and its affiliates that would potentially cause the largest aggregate credit exposures to the CCP in extreme but plausible market conditions.

The LCH risk management framework is designed to measure, monitor, mitigate and manage risks posed to LCH and its clearing members. LCH maintains financial resources sufficient to cover the default of the two member groups with the largest exposures under extreme but plausible conditions. LCH's overall risk management framework sets out internal policies, procedures and processes to identify and manage current and potential future credit exposures that arise as a result of LCH's business activities and operations. Policies require that variation margin is collected to manage current exposures; initial margin is collected to meet potential future exposures over conservative holding periods, at least a 99.7% level of confidence; and default fund resources are sized based on covering the defaults of two member groups in a range of theoretical and historical stress scenarios. LCH assesses margin coverage, and calls margin where necessary, multiple times each day.

Key Consideration 1: An FMI should establish a robust framework to manage its credit exposures to its participants and the credit risks arising from its payment, clearing, and settlement processes. Credit exposure may arise from current exposures, potential future exposures, or both.

LCH manages its credit exposures to clearing members through the maintenance of prefunded financial resources, the enforcement of participation criteria, and regular monitoring. In addition, the LCH Rulebook allows LCH to call for additional funds from clearing members under certain conditions.

LCH calculates Internal Credit Scores (ICS) for each clearing member and other counterparties to which LCH has an exposure through an assessment of both quantitative and qualitative factors. These ratings influence LCH's risk management function's response to more specific risks identified by daily monitoring, as well as determining the frequency of future assessments of each clearing member. These internal credit ratings are also considered by internal risk governance.

LCH's risk management function is responsible for reviewing each clearing member's creditworthiness and financial condition. Clearing members' positions are monitored continuously, with particular focus on the size of each clearing member's cleared positions relative to its capital and to the total open interest in a particular contract.

Further, all new products are subjected to the risk governance process in order to ensure that all new risks introduced by a new product or market (or maturity) are appropriately assessed as to their impact on the current risk management practices. Where additional risk measures are required, such as amendments to existing margin calculations, these are proposed along with a formal application to clear the new products through the risk governance process.

LCH's credit scoring framework is reviewed at least annually, as part of the regular policy review. This review will take account of changes to the business and market environment, market practices and new products; recommendations to change will be presented to the LCH Board Risk Committee and LCH Board for approval.

Key Consideration 2: An FMI should identify sources of credit risk, routinely measure and monitor credit exposures, and use appropriate risk-management tools to control these risks.

LCH identifies sources of credit risk in its internal Risk Policy, listing the following within scope: clearing members and (indirectly) their clients, interoperating CCPs, sovereigns and all other intermediaries. The latter group includes investment counterparties, concentration banks, central securities depositories, settlement agents and custodians.

Credit risk from clearing members arises from potential non-payment of monies due to LCH, e.g. settlement amounts, margins, default fund contributions and fees. Once a clearing member is placed into default, losses may be incurred during the liquidation/transfer of that member's positions, including those of any clients. Risks are mitigated through the provision of collateral for margins which is monitored and can be adjusted intra-day, default fund contributions which are monitored daily and adjusted monthly, and LCH's own capital.

Credit risk from interoperating CCPs arises from potential non-payment of monies due to LCH, e.g. settlement amounts and margins. If an interoperating CCP is placed into default, losses may be incurred during the liquidation/transfer of that CCP's positions. Risks are mitigated through the provision of collateral for margins which is monitored and adjusted intra-day and LCH's capital. Please see *Principle 20* for more information on linked FMIs.

Credit risk from sovereigns (including government agencies and supranationals, where eligible) arises from investment of member cash margins or LCH's own capital in debt issued by or guaranteed by a sovereign. Credit deterioration (at extreme a default) of the sovereign may lead to the potential inability of LCH to realise the full investment amount including interest accrued.

Risks are mitigated through haircuts on securities and concentration limits on issuers, loss allocation to members and LCH's own capital.

Credit risk from sovereigns (including government agencies and supranationals, where eligible) also arises from acceptance of debt issued or guaranteed by a sovereign as collateral from a clearing member to meet margin liabilities. Credit deterioration of the sovereign may lead to the potential inability of LCH to achieve sufficient value from sale of sovereign debt realised during liquidation/transfer of a defaulting clearing member's portfolio.

Risks are mitigated through haircuts on securities and concentration limits on issuers; the ability to call for other forms of member margin collateral, and default fund contributions which are monitored daily and adjusted monthly.

Credit risk to investment counterparties and concentration banks arises from the holding of unsecured cash deposits with credit institutions which may be lost in the event of such a credit institution's default. Risks are mitigated through credit criteria and limits, intraday monitoring and management, non-default loss allocation to members and LCH's capital.

Credit risk to Central Securities Depositories (CSDs), including International Central Securities Depositories (ICSDs), settlement agents and custodians arises from the holding of securities in the name of LCH and its members, and from time to time small cash amounts arising from settlement fails. Such fails also occasionally give rise to cash or securities being held at (I)CSDs, settlement agents or custodians overnight. Risks are mitigated through the legal segregation structure covering such assets, monitoring of limits, non-default loss allocation to members and LCH's capital.

Exposures to all these entities are calculated at least daily.

LCH calculates internal credit ratings for each clearing member through an assessment of both quantitative and qualitative factors, on a review cycle based on ICS. These ratings influence LCH's risk management function's response to more specific risks identified by daily monitoring, as well as determining the frequency of future assessments of each participant. LCH monitors all clearing members' compliance with LCH's net capital requirement on an on-going basis and clearing members are obliged to provide certain financial information for this purpose as set out in the LCH Rulebook. All clearing members are also obliged to immediately notify LCH in the case of a significant reduction in their shareholders' funds or net capital as compared to their previous financial returns.

The following tools are used to limit credit risks arising from investment, payment, settlement and custody activities:

- Outright and concentration limits per counterparty and instrument type, scaled by ICS;
- Application of haircuts on securities received as collateral;
- Intraday and overnight limits for intermediaries;
- Use of Delivery Versus Payment (DVP) where appropriate;
- Use of central bank facilities where available; and
- Preference for (I)CSDs over credit institutions.

The continued appropriateness and effectiveness of these tools is monitored through daily exposure and limit reporting as well as part of the annual policy review.

Key consideration 3 is not applicable to CCPs.

Key Consideration 4: A CCP should cover its current and potential future exposures to each participant fully with a high degree of confidence using margin and other prefunded financial resources (see Principle 5 on collateral and Principle 6 on margin). In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should maintain additional financial resources to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the two participants and their affiliates that would potentially cause the largest aggregate credit exposures for the CCP in extreme but plausible market conditions. All other CCPs should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliate that would potentially cause the largest aggregate credit exposure for the CCP in extreme but plausible market conditions. In all cases, a CCP should document its supporting rationale for, and should have appropriate governance arrangements relating to, the amount of total financial resources it maintains.

LCH uses variation margin, initial margin, a dedicated portion of its own resources and five mutualised, service specific default funds[6], to cover current and potential future exposures to its clearing members.

Variation margin is called at least daily to cover market price movements on each clearing member's positions. Initial margin is called at least daily and is calibrated to a 99.7 percent confidence level, assuming an appropriate holding period and using market prices from a sufficiently long lookback period. Further margins (add-ons) are called from members who have weak credit scores, those that have large or concentrated positions, or positions that are illiquid or exhibit correlation with the member itself; and in some circumstances where the clearing member has excessive exposures modelled under stress scenarios.

In order to cover potential future exposures to clearing members under extreme but plausible market conditions, clearing members contribute to the service specific default funds. LCH is considered to be systemically important in multiple jurisdictions and therefore maintains additional financial resources sufficient to cover a wide range of potential stress scenarios that include, but are not limited to, the default of the two clearing members and their affiliates that would potentially cause the largest aggregate credit exposure for LCH in extreme but plausible market conditions. Therefore, these default funds are sized to meet the largest two member stress losses above margins (including those of clients and affiliates), applying a set of scenarios of extreme but plausible market conditions. A buffer of 10% is added, and LCH retains the ability to resize Default Funds outside of the monthly cycle if necessary.

The default funds' values may be subject to the application of a floor or cap, as prescribed in the

[6] The CommodityClear default fund is set to be closed when the Service ceases operation by 29th December 2017

service-specific Supplements to the LCH Default Rules. In such cases, the daily Clearing Limits described under *Key Consideration 6* will apply.

The Rates Derivatives Default Fund is augmented by a Trade Registration Fund (TRF). This an additional pool of resources contributed to by SwapClear clearing members to facilitate real time trade registration, by permitting the acceptance of trades for which the member has insufficient prefunded margins. The usage per member at any time is strictly limited. In the event of a default, the TRF forms part of the mutualised Rates Derivatives Default Fund available to LCH.

LCH places a portion of its own resources, an amount equal to 25 percent of its minimum net capital held in accordance with Article 16 of EMIR and Commission Delegated Regulation (EU) No 152/2013 RTS, ahead of all non-defaulting members' contributions to the mutualised default funds.

The sizes of each default fund and of each amount of own capital is published at http://www.lch.com/risk-collateral-management/risk-management-overview, under "The Default Fund Waterfall".

There are underlying procedures and model documentation for each of the services that outline the key principles adopted for the calculation of initial margin, variation margin and default funds to cover credit exposures to each clearing member. All such models are independently validated at least annually.

Variation Margin liabilities must be covered by clearing members in cash. Liabilities for Initial Margin Contingent Variation Margin and further margins may be met by clearing members either in cash, in a set of eligible currencies, or by pledge of securities issued or explicitly guaranteed by high quality sovereigns, supranationals and government agencies.

Contributions to default funds are only acceptable in cash, using prescribed currencies.

Margins are calculated separately for each proprietary account and for each client account. DF contributions are calculated per clearing member

Prompt access to these resources is ensured through the use of high quality custodians for assets pledged and the investment of cash received according to the internal policy, which sets minimum standards for the security, quality and liquidity of assets and instrument type.

As described above, LCH's Risk Appetite and policies establish that a confidence level of 99.7 percent is used to cover LCH's close-out losses in the event of a member default in all but extreme market conditions. The sufficiency of these financial resources is evaluated on a daily basis via statistical tests results and backtesting coverage ratios. A reduction in coverage would initiate further investigation which may lead to a formal model review in accordance with LCH's model validation governance. Interim measures include amending configurable model parameters and/or calling additional margin from affected members until model remediation is complete. LCH's risk controls include a range of financial resources to cover its credit exposures. These consist of: margin provided by clearing members in respect of their outstanding positions; capital contributions from LCH; and segregated, mutualised default funds of prefunded contributions from clearing members. These resources would be used in the following order to cover loss due to a clearing member's default: the defaulted clearing member's margin and default fund contributions; LCH's capital contribution; and contributions from non-defaulting clearing members to the relevant default fund.

The LCH Rulebook provides for the segregation of each of the Commodities, Equities and Equity Derivatives, RepoClear, ForexClear and Rates Derivatives Default Funds from the financial resources of each other under a limited recourse structure; accordingly, the financial contributions of non-defaulting clearing members to each default fund cannot be utilised to meet losses arising from the default of clearing members in other services. Further, this segregation provides for the continuation of LCH's other services should any single service close.

Stress losses on each clearing member's positions, including those of its clients and affiliates, are modelled each day against the set of extreme but plausible stress scenarios used to size the default fund and netted against margins held. In addition to the daily stress testing of default fund adequacy, quarterly reverse stress testing is carried out to examine the stress testing results to determine whether there exists a combination of more than two members defaulting under the same scenario which would result in the default fund being exhausted. The results, together with any recommended actions, are reviewed by internal risk governance and are reported to the Risk Committee quarterly.

The rationale for the financial resource sizing is documented in both the LCH Board's Risk Appetite statement and the LCH Board approved suite of risk policies. Risk Appetite is expressed in the Risk Governance Framework, issued by the LCH Board at least annually, which establishes the risk appetite and tolerance for each identified risk, and sets the high level standards it expects LCH to adopt in managing such risks.

LCH maintains policies covering each of the risk types and detailing how each risk is managed according to the LCH Board's expectations. These policies are subject to a thorough review at least annually by internal risk governance and the Risk Committee and approved by the LCH Board.

Key Consideration 5: A CCP should determine the amount and regularly test the sufficiency of its total financial resources available in the event of a default or multiple defaults in extreme but plausible market conditions through rigorous stress testing. A CCP should have clear procedures to report the results of its stress tests to appropriate decision makers at the CCP and to use these results to evaluate the adequacy of and adjust its total financial resources. Stress tests should be performed daily using standard and predetermined parameters and assumptions. On at least a monthly basis, a CCP should perform a comprehensive and thorough analysis of stress testing scenarios, models, and underlying parameters and assumptions used to ensure they are appropriate for determining the CCP's required level of default protection in light of current and evolving market conditions. A CCP should perform this analysis of stress testing more frequently when the products cleared or markets served display high volatility, become less liquid, or when the size or concentration of positions held by a CCP's participants increases significantly. A full validation of a CCP's risk-management model should be performed at least annually.

LCH assesses the sufficiency of the default funds through daily stress testing. Sufficiency is assessed with reference to the sum of the two largest stress test losses under extreme but plausible scenarios, plus the stress test losses of the relevant members' affiliates and clients. This process involves the daily revaluation of each clearing member's portfolio using a set of historical and theoretical stress test scenarios incorporating price and volatility shifts to estimate a worst-case loss in excess of that clearing member's initial margin.

Stress test results are continually reviewed and monitored by the risk management function, with formal approval sought on changes to the framework as necessary from the LCH Board with recommendations made by the Risk Committee.

The LCH Chief Risk Officer is responsible for implementing and maintaining the framework, making recommendations as necessary to maintain a robust framework and reporting to, or seeking approval as necessary from, the LCH Board.

The stress testing framework is independently reviewed annually, with a full review of the coverage of the contracts cleared, model assumptions and parameters. This process also involves a review of stress test scenarios to ensure their plausibility and accuracy. In addition, ad hoc reviews are carried out when it is deemed that a change in the market may have a material impact on any scenario's plausibility, or on the launch of a new product.

In addition, reverse stress testing is carried out regularly which examines whether plausible scenarios may exist which would produce more extreme results than those of the current suite of scenarios. The results, together with any recommended actions, are reported to the Risk Committee quarterly.

An internal policy sets out all the relevant steps relating to a new or changed model from initiation to independent validation, encompassing a regular model performance review and ensuring that any model changes are within the LCH Board's Risk Appetite. Independent validation is conducted by an LCH internal independent specialist team or by external specialist independent firms at least annually.

The results of the reviews are analysed internally and shared with the Risk Committee and regulators, together with recommendations of the independent teams and actions taken.

Key Consideration 6: In conducting 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.

LCH maintains a record of historical stress test scenarios covering financial crises and exceptional trading days in the last 30 years. These are a well recognised set of past stresses in use today by most financial institutions. Any changes are subject to approval by the Executive Risk Committee and are reported to the LCH Ltd Risk Committee. Such changes will lead to the inclusion of scenarios covering new periods of increased market volatility which are added to the set of historical stress-test scenarios as soon as practicable.

In addition, LCH maintains and regularly reviews a suite of theoretical scenarios which entail either a remodelling of historically observed scenarios, with more extreme movements and/or de-correlation, or hypothetical scenarios including for example a sovereign default, price changes and yield curve shifts.

Together, the scenarios suite covers historical, antithetic, theoretical, de-correlation and Portfolio Specific Liquidity (PSL) stresses. The PSL scenarios are stresses which seek to uncover hidden risks such as basis and spread risk specific to particular portfolio types. The PSL approach is well suited to generate distribution led portfolio dependent scenarios which complements the traditional risk factor push methods. These mechanisms ensure that the scenarios include extreme but plausible conditions for all clearing member portfolios.

The stress scenario suite, together with the default fund sizing methodology, is independently validated at least annually.

Key Consideration 7: An FMI should establish explicit rules and procedures that address fully any credit losses it may face as a result of any individual or combined default among its participants with respect to any of their obligations to the FMI. These rules and procedures should address how potentially uncovered credit losses would be allocated, including the repayment of any funds an FMI may borrow from liquidity providers. These rules and procedures should also indicate the FMI's process to replenish any financial resources that the FMI may employ during stress events, so that the FMI may continue to operate in a safe and sound manner.

All clearing members of LCH are bound by the LCH Rulebook. If a clearing member defaults, then the Default Rules, particularly Rule 15 of the Default Rules and the provisions of each "Default Fund Supplement", establish a waterfall to allocate the losses arising from the default. The losses are allocated in the following order:

1. Defaulter's margin
2. Defaulter's contribution to all LCH Default Funds
3. A pro rata allocation of LCH's capital calculated in accordance with Article 35 of Commission Delegated Regulation (EU) No 153/2013 RTS supplementing EMIR
4. Non-defaulters' funded contributions to the relevant default fund that covers the service(s) in which the defaulter has caused losses
5. An unfunded contribution from each non-defaulter equal to the non-defaulter's funded contribution to the default fund(s) in which the defaulter has caused losses. Only one unfunded contribution may be called per default, and no more than three unfunded contributions can be called in a six month period

6. A daily loss allocation to non-defaulters based either on cumulative gains (SwapClear and ForexClear) or an allocation of the daily shortfall pro rata to the funded contribution to the relevant default fund (RepoClear, Equities and Equity Derivatives, Commodities and Listed Rates). This step may be subject to a cap
7. In the cases of SwapClear and ForexClear, LCH may then invite non-defaulting clearing members to make voluntary contributions for service continuity. In the cases of RepoClear, Commodities and Listed Rates, clearing members must pay a further amount equal to their loss allocation
8. If there are further losses, open contracts of an affected service are closed out with any shortfall being allocated pro rata across those clearing members who are owed funds from the service.

The process outlined above applies to both a single default and the default of multiple clearing members. CCPs with which LCH has an interoperable link do not contribute to default funds; losses arising in excess of margins held from a defaulted co-CCP will be offset by the same waterfall of resources as with the default of a clearing member, including the relevant default fund.

In the event that LCH borrows funds from a liquidity provider in order to manage a default, then the cost of funding and the repayment of the borrowed amount will be met through the resources in the default waterfall.

LCH has five default funds. Each default fund is established via a “Default Fund Supplement” contained in the Default Rules.

Following the completion of the default management process, the relevant default fund enters a 30 calendar day “cooling off period”. During the cooling off period, each default fund may be replenished to the level of its floor, within 2 days, but it is otherwise held at its post-default level until the end of the cooling off period. During this time Default Fund Additional Margin (DFAM) is called to ensure that the waterfall is fully funded and meets the cover 2 standard. At the end of the cooling off period, the relevant default fund is subject to a full recalculation and it is funded up to its recalculated level.

At all times, each non-defaulting clearing member is appropriately margined and a non-defaulter’s margin is not used for default management.

The Clearing Limits described under Key Consideration 3, whereby clearing members whose net stress losses exceed 45 percent of the default fund value are required to post daily DFAM, are applied at all times including during the management of a member default when the default fund value may be decreasing.

Any capital expended by LCH as part of the default management process would be replenished from its own resources, as described in the Recovery Plan.

Publicly available resources	Rulebook Risk Management Overview Default Waterfall Acceptable Collateral Public quantitative disclosure standards for central counterparties

Principle 5: Collateral

An FMI that requires collateral to manage its or its participants' credit exposure should accept collateral with low credit, liquidity, and market risks. An FMI should also set and enforce appropriately conservative haircuts and concentration limits.

Only financial instruments that are of high quality, highly liquid, and with low credit and market risk can be considered for LCH's eligible collateral list. LCH's risk policies take such criteria into consideration and set the standards for the acceptance of collateral. This policy framework, along with underlying procedures, incorporates development of appropriate haircuts, addresses the need for pro-cyclical adjustments and application of concentration limits and monitoring, and provides for responsive and comprehensive operational systems and processes.

Key Consideration 1: An FMI should generally limit the assets it (routinely) accepts as collateral to those with low credit, liquidity, and market risks.

LCH has a policy in place that sets out the types of acceptable collateral and the criteria for determining eligibility. For instance, acceptable collateral must be in a currency in which LCH clears products, and for which there is an established Foreign Exchange (FX) market with a published FX rate; financial instruments must be high quality, highly liquid and with low credit and market risk – there must be sufficient market liquidity, and it must be possible to establish mark-to-market value daily using an observed process from published sources. For financial instruments the issuer must meet a minimum ICS, and be approved through appropriate LCH governance processes. Further, for any exceptions to the policy, it is required that a formal request for approval is made to the Executive Risk Committee (ERCo). If ERCo approves the exception, this decision is notified to the Risk Committee (RiskCo). However, it should be noted that there have never been any exceptions granted to the collateral policy for LCH. The use of exceptions is there as a contingency measure and only to be used in exceptional circumstances. The Collateral Risk policy is reviewed annually and any revisions are subject to Board approval

.

LCH operates and maintains a Collateral Management System (CMS) through which requests by clearing members to deposit or release collateral are made. CMS lists only LCH eligible collateral, thereby preventing the submission or receipt into LCH of ineligible collateral.

LCH maintains a framework for the monitoring and identification of wrong-way and other concentration risks. The framework includes policies that require review and escalation when breaches of concentration limits occur, along with mitigation steps.

LCH's risk policies are reviewed on an annual basis, and details of eligible collateral including haircuts are published on the LCH website.

Key Consideration 2: An FMI should establish prudent valuation practices and develop haircuts that are regularly tested and take into account stressed market conditions.

LCH marks its collateral holdings to market daily, using observed market prices from published sources in accordance with internal LCH policy.

LCH is entitled to give any instrument or security lodged as collateral a zero value if it is found in any way to be unacceptable. Further, if, in the opinion of LCH, any asset that has been transferred to it by a clearing member as collateral, is no longer either of sufficient value or otherwise acceptable to LCH, it shall be entitled to demand further collateral from such member, in keeping with LCH Rulebook provisions.

LCH's internal policies define its collateral haircut framework: the framework includes quarterly monitoring and review of haircuts, and a stress testing regime that contains extreme but plausible scenarios. Collateral haircuts are made up of a base haircut as well as add-ons, and cover market risk, credit risk, wrong-way risk and FX risk in addition to concentration and liquidity risk. Haircuts must also comply with the internal policy on procyclicality.

Key Consideration 3: In order to reduce the need for procyclical adjustments, an FMI should establish stable and conservative haircuts that are calibrated to include periods of stressed market conditions, to the extent practicable and prudent.

During the review of haircuts, LCH may defer or phase changes to haircuts if deemed necessary, to avoid excessively procyclical effects. LCH internal policies require that a 10 year price history be used in haircut calibrations thereby reducing the need for procyclical adjustments. A test for procyclicality of margin collateral haircuts is performed as part of every margin collateral haircut review – this is performed at least quarterly.

Key Consideration 4: An FMI should avoid concentrated holdings of certain assets where this would significantly impair the ability to liquidate such assets quickly without significant adverse price effects.

LCH monitors clearing member collateral holdings for concentration risk. Internal risk policy and the LCH Rulebook allow LCH to place concentration limits on particular asset types and to manage specific concentrations within collateral portfolios, and takes into consideration the ability to realise the value of a piece of collateral during normal and volatile market conditions. For securities collateral that is delivered via either bilateral or triparty mechanisms, LCH specifies concentration limits on issuers in line with internal risk policy.

Key Consideration 5: An FMI that accepts cross-border collateral should mitigate the risks associated with its use and ensure that the collateral can be used in timely manner.

Where a clearing member delivers securities, including cross-border delivery, the securities are held in accounts in the name of LCH at the relevant (International) Central Securities Depository ((I)CSD) or custodian, under a deed of charge in favour of LCH, in some cases through the sub-custody arrangements of an (I)CSD. LCH takes legal opinions in relation to the jurisdictions in which collateral assets, and their issuers, are located, and on the enforceability of its Rulebook on a 2-3 year cycle, unless there is a change that requires additional legal advice in the intervening period.

LCH holds non-cash collateral in accounts in its name at CSDs to enable it to access such collateral in a timely manner.

LCH only applies securities to clearing members' collateral accounts when the (I)CSD or custodian has confirmed settlement has occurred. This process is the same for both domestic and cross-border delivery of securities. LCH performs due diligence of its (I)CSDs and custodians to ensure ongoing compliance with its settlement finality rules and segregation requirements.

LCH aligns its cut-off times with respect to receipt of securities with the cut-off times of the relevant (I)CSDs and custodians. See further discussion under *Principle 17: Operational Risk* and *Principle 20: FMI links*.

Key Consideration 6: An FMI should use a collateral management system that is well-designed and operationally flexible.

CMS provides clearing members with a real-time view of collateral balances on relevant accounts at LCH, and provides functionality that allows clearing members to instruct movements of collateral to or from LCH and between the accounts of a clearing member, and in line with LCH's cut-off times and thresholds. CMS also provides information to clearing members on its securities valuations, including haircuts, FX and price data; liability data, i.e. initial margin obligations for each clearing member account; and excess collateral valuation.

The LCH Rulebook does not provide for re-use of member non-cash collateral, except in the event of default of that clearing member. LCH may then appropriate or sell the non-cash collateral of that defaulting clearing member and apply the proceeds to that clearing member's liabilities.

CMS is integrated with the back office systems of LCH and is able to instruct changes to collateral balances upon external provision of settlement data from (I)CSDs. CMS is also able to instruct movements of cash to and from clearing member nostro accounts at designated banks, while other LCH systems perform tasks that include maintenance of books and records, carrying out the required checks and balances, and production of regular reports and management information required for the ongoing monitoring and management of collateral. CMS and associated systems are subject to a review process to ensure that they are adapted to new monitoring and management functions, e.g. the addition of new (I)CSDs. LCH Collateral Operations, which manages CMS operates from 6am to 12am (UK Time) and has staff in London, New York and Sydney.	
Publicly available resources	Acceptable Collateral and haircuts Collateral Management System Collateral Service Description Rulebook Legal Opinions Public quantitative disclosure standards for central counterparties

LCH The Markets' Partner

Principle 6: Margin

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.

The LCH risk management framework incorporates policies which set out risk-based standards for margin models, as well as procedures and processes to calculate a clearing member's risk position and initiate margin calls. The framework requires monitoring of clearing member positions, in addition to mark-to-market calculations and the collection of margin intraday if necessary. Margin levels are backtested daily, to assess whether the models are performing at the desired level of confidence (99.7%).

Key Consideration 1: A CCP should have a margin system that establishes margin levels commensurate with the risks and a particular attributes of each product, portfolio, and market it serves.

LCH's general framework of margining consists of the calculation and collection of intraday and end-of-day initial margin and variation margin. Initial and variation margin is collected from LCH's clearing members to cover the risk that members are unable to fulfil their obligations as set out within the LCH Rulebook and Clearing Member Agreement.

Initial margin performance is assessed on a daily basis through member portfolio backtesting. All of LCH's margin models have to pass both the regulatory defined minimum backtesting threshold and the thresholds established by LCH's Risk policies and procedures.

Credit exposures arise from latent market risk. Adverse changes in the value of the contracts and products can be attributed to a wide range of risk factors such as interest rates, FX rates, equity prices, commodity prices, credit spreads and implied volatility. Further credit exposures can arise from the cost of securing liquidation for concentrated positions and/or illiquid contracts.

LCH's margin models are specifically designed to capture the key risk factors that affect the value of the contracts. The changes in the values of each risk factor and combinations of risk factors are assessed over a wide range of possible outcomes. The initial margin reflects the worst of these outcomes given a pre-defined confidence interval and holding period.

In instances where it is not possible to model all the risk factors that contribute to the potential adverse change in the value of a contract or product, an additional margin will be applied to mitigate this risk. For example, LCH has the ability to apply liquidity and concentration risk margin for large positions.

LCH has processes in place to calculate and make regular margin calls. By having regular intraday margin calls, the period for which there is an uncovered exposure is minimised and therefore the risk of a clearing member payment failure leading to a large margin shortfall is mitigated.

Clearing member payment failure is, prima facie, an event of default. This is likely to trigger LCH's default management process which entails a wide range of measures that not only prevent the risk increasing but reduce and eliminate all open positions. The default management process is regularly rehearsed through default fire drills.

LCH has fully documented the margin methodology for all of its clearing services. In addition, as required by LCH's risk policies, all margin models are annually reviewed by independent model validation specialists, as well as following either material changes or the introduction of a new model.

The results of the respective independent margin model validation, including any actions that LCH may undertake, are subject to a review by LCH's internal risk governance, including an annual review by the LCH Board.

LCH discloses key components of the respective margin model on its public website. In addition, further information is made available to clearing members and is routinely discussed at LCH's Risk Committee or in Product Advisory or Risk Working Groups, which have clearing member participation.

Key Consideration 2; A CCP should have reliable source of timely price data for its margin system. A CCP should also have procedures and sound valuation models for addressing circumstances in which pricing data are not readily available or reliable.

LCH uses prices from public venues or exchanges, should price discovery occur at such venues, for all its clearing services. For clearing services where price discovery is based on reliance on broker-dealer quotes in OTC markets, such quotes are required. The broker-dealer prices can be obtained directly and via published composite or multi-contributor sources.

The same sources are used to build price history data that comprise the market input for the margin models.

LCH has policies and procedures that require prices to be available both intraday and at end of day and set out criteria for the quality and reliability of price sources used. There are price validation controls in place to identify when prices have become stale, changed value excessively or the provider ceases to publish price information.

Where a price is not readily available or reliable, LCH will utilise an alternative price source. In the event all sources become unreliable, and as set out in LCH's Rulebook, the last known price will be used as the input into the margin requirement until a suitable replacement is found. If no suitable replacement exists the contract may not be eligible for clearing and can be suspended.

LCH's polices define the approach to ensuring the presence and coverage of price sources. If reliable price sources are not readily available this may constitute a barrier to enabling clearing for the respective product. If reliable prices are available but not historically, for example a new issue that has not traded before, a proxy price will be used to generate the risk factor estimate required for the margin model.

The choice of proxy is determined by a number of considerations such as economic equivalence, correlation and volatility. If the best choice of proxy is still weak the initial margin coverage can be increased by allocating the contract to a more conservative margin group or more conservative liquidity banding.

Finally, all margin models are subject to independent review at least annually. The review scope includes an evaluation of pricing models, market data and the use of proxies should they be used. The findings of the review are subject to LCH‟s risk governance review.

Key Consideration 3: 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 close out of positions following a participant default. Initial margin should meet an established single-tailed confidence level of at least 99 percent with respect of the estimated distribution of future exposure. For a CCP that calculates margin at the portfolio level, this requirement applies to each portfolio's distribution of future exposure. For a CCP that calculates margin at more-granular levels, such as at the subportfolio level or by product, the requirement must be met for the corresponding distributions of future exposure. The model 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 exposures 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.

LCH's initial margin model consists of both analytical (Value at Risk (VaR)-like) models and empirical (SPAN-like) models. The confidence interval and minimum level of coverage is determined by the LCH Board Risk Appetite and is set at 99.7 percent for all initial margin models.

(A) Analytical models

The key assumptions under the analytical models include a combination of the following:

- Return assumptions
- Holding period assumptions
- The empirical distribution of historical returns of each individual risk factor reflects a reasonable and likely distribution of potential outcomes over the holding period
- Scaling of returns improves predictive power of the history
- The choice of Exponentially Weighted Moving Average (EWMA) decay factor represents the most appropriate speed of adjustment to changes in market volatility
- There is equal probability of scenario occurrence; and
- The defaulter's portfolio is held constant over the chosen holding period

Analytical models are listed as follows:

Market	Margin method used	Look-back period	Holding period
SwapClear	Portfolio Approach to Interest Rate Scenarios (PAIRS) (historical simulation with volatility scaling)	10 years	5 days (7 days for client positions)
ForexClear	Foreign Exchange Portfolio Analysis and Risk (FxPAR) (historical simulation with volatility scaling)	10 years	5 days (7 days for client positions)
RepoClear	Historical simulation with volatility scaling	10 years	5 days (no client positions)
Listed Rates	Historical simulation with volatility scaling	5 years	2 days for members and clients
EquityClear	Historical simulation or flat percentage*	1 year	2-7 days depending on positions

* applied to relatively illiquid securities or securities with a limited history of trading.

LCH additionally applies margin requirement 'multipliers' by clearing member to cover further credit, liquidity, concentration and sovereign risks that exceed the assumptions of the base calculation.

Procyclical margining changes are mitigated through features such as averaging the largest losses, the application of counter-cyclicality buffer and the use of long-term margin floor. For example, the risk of overly procyclical margining in the FxPAR and PAIRS models is mitigated through features such as the averaging of the largest simulated losses; the use of a relatively long look-back period; the use of exponentially weighted moving average volatility scaling; and the use of a percentile long-term quartile margin floor.

(B) Empirical models

The key assumptions under the empirical (SPAN-like) models are:

- Return assumptions
- Holding period assumptions
- Historical correlations continue to hold true under normal market conditions
- Log returns follow a normal distribution and constant volatility
- There is equal probability of scenario occurrence
- Offsets are applied only to offsetting positions and positions in the same direction are assumed to have unit correlation; and
- The defaulter's portfolio is held constant over the chosen holding period

LCH has a margin model standard whereby initial margins should not jump significantly (by more than 25%) over the holding period during a replay of history model test. The natural length of time to consider in assessing this standard is a 10 year market history, as this is then compatible with the

EMIR standard on procyclicality. Implicitly, this formally recognises that a 10 year period is enough to capture the full economic cycle. The 25% jump over the holding period is suggested by the ESRB standard of 25% for a procyclical buffer.

Procyclical margining changes in other models with a lookback period of less than 10 years are mitigated through features such as the application of a counter-cyclicality buffer, the use of long-term margin floor and/or the inclusion of stressed returns.

Empirical models are listed as follows:

Market	Margin method used	Look-back period	Holding period
Commodity Clear	London SPAN	1 year	2-5 days depending on positions
LSEDM	London SPAN	1 year	2 days for members and clients

The main margin rate is the scanning range, which is the higher of:

- Three standard deviations of historic volatility based on the higher of one-day or two-day relative price movements in the lookback period, or
- 100 percent of the highest one or two day percentage price move over the lookback period.

For all models:

Margin rates may be adjusted to account for contracts which are affected by external events in the period under review, such as political, seasonal, and economic. All material adjustments to margin rates must be approved by the Executive Risk Committee and will be notified to the Board Risk Committee.

The additional margins such as concentration and liquidity margin are threshold based. The thresholds are calibrated using market data such as observed volumes and open interest on public exchanges or using survey derived data from participants in OTC markets. Thresholds derived from surveys are benchmarked to internal cleared trading data and subjected to regular review by the respective DMGs.

SwapClear margin assumes a 5 day margin period of risk for members, and 7 days for clients. The incremental 2 days for clients is to allow an opportunity to port to backups, though the formal legal porting window is only 24 hours and client default management is expected to be completed within 5 days. During fire drill exercises, the DMG is explicitly instructed to assume stressed markets for both the construction and pricing of the relevant hedge trades. In all exercises, the DMG has indicated that bulk of risk can be mitigated in the first day, with a second day required to clean up more minor risks and fine tune the portfolio ahead of auctions. The costs given by the DMG are compared against both external counterparties and survey results. All positions in SwapClear are subject to a liquidity add-on (referred to as IMMFP or IMM2), which is calibrated to a market counterparty survey. Traders are required to fill in the costs of exiting a range of large positions over a 2 day period. In no exercise has the liquidity margin been exhausted in hedge costs.

LCH is therefore comfortable that even a significant risk position could be closed out within margin levels inside the assumed close out period.

Key model parameters are determined by calibration to backtesting performance, margin stability, reactivity and decay metrics, liquidity thresholds, historical volatility and benchmarking.

The following factors are considered when determining the appropriate close-out period:

- Duration to formally execute the default notice, inform stakeholders, remove market access and initiate the Default Management Group
- Duration to agree exit strategy, hedge trades and auction portfolios
- Duration to execute the exit strategy in a normal market or stressed market; and

- Duration to initiate and complete the client porting process

At least 10 years of data is obtained for the historical sampling period. This ensures at least one economic cycle is captured. Where 10 years of data is not available or is unreliable or creates excessive data overhead, a shorter sample is used, either five years or one year. The shorter samples are subject to a long term (10 year) floor which limits how far margins can reduce when recent volatility is trending lower, thereby ensuring model coverage and reducing procyclicality.

LCH's Default Management Process does not seek to maintain open positions in a default beyond the holding period. Therefore adverse price affects are assumed when closing out large or illiquid positions.

Two types of wrong-way risk have been identified. Firstly, specific wrong-way risk arises where a member has exposure in collateral provided in the form of its own securities or affiliates' securities. This type of wrong way or self referencing risk is not permitted, i.e. members cannot post collateral in their own name, in the case where it does arise in the clearing exposures such as a member trading in its own name then the margin requirement is a flat 100% of the specific wrong way exposure. Secondly, general wrong-way risk arises when a member's portfolio is highly correlated to the country of domicile or the member's creditworthiness, or that the assets and liabilities in the member's portfolio are highly correlated.

The consequence is that in certain scenarios, the member's exposure can be magnified due to these linked risks. Where wrong-way risk arises, additional margin is called to mitigate the adverse correlation.

Key Consideration 4; A CCP should mark participant positions to market and collect variation margin at least daily to limit the build-up of current exposures. A CCP should have the authority and operational capacity to make intraday margin calls and payments, both scheduled and unscheduled, to participants.

LCH marks clearing members' positions to market and collects variation margin for all clearing services every day.

Variation margin for exchange-traded contracts is defined as:

(today's closing price - yesterday's closing price) x number of contracts x contract size

The closing price is sourced from the relevant exchange.

Variation margin for OTC contracts is defined as:

(today's net present value - yesterday's net present value)

The net present value is the sum of the discounted cash-flows. The discount factors and forward rates are derived from zero coupon pricing curves. The pricing curves are constructed using a bootstrapping approach with pre-defined interpolation methods such as linear or cubic spline from valid market data.

LCH has the authority and operational capability to make intraday margin calls for each clearing service. All intra-day margin calls account for adverse changes in both variation margin and initial margin. Margin calculations are based on intraday positions and valuations.

Key Consideration 5: In calculating margin requirements, a CCP may allow offsets or reductions in required margin across products that it clears or between products that it and another CCP clear, if the risk of one product is significantly and reliably correlated with the risk of the other product. Where two or more CCPs are authorised to offer cross-margining, they must have appropriate safeguards and harmonised overall risk-management systems.

LCH permits offsets within certain classes of products within a common default fund. There are no offsets between default funds, and there are no offsets across CCPs.

Offsets are implemented directly by spread margins or inter-commodity spread credits between two contracts or indirectly by portfolio margin methods.

LCH The Markets' Partner

The estimate of the potential future exposure (PFE) is determined from an empirical model such as SPAN or an analytical historic simulation such as VaR or expected shortfall.

For the empirical models such as SPAN each product will have an associated risk estimate called the scanning range. The scanning range will be the higher of:

- Three standard deviations of historic volatility based on the higher of one day or two day relative price movements in a one lookback period, or
- 100 per cent of the highest one or two day percentage price move over a one year lookback period.

Combinations of the scanning ranges are arranged to create 16 scenarios for each product. The PFE of the product is the worst outcome of the 16 scenarios. The PFE of the portfolio is the sum of the product worse outcomes less any allowable spread credits (offsets).

For the SPAN models the price dependency is captured in the allowable offsets. Where contracts are correlated with one another, the inter-commodity credit recognises this, by reducing the outright initial margin (scanning range) by a percentage, depending on the level of correlation. In setting the inter-commodity offset, the following requirements must apply:

- The difference in daily price moves of the two contracts are used in the evaluation;
- A maximum of one breach of the inter-commodity offset over a 1 year period; and
- The maximum offset is capped at 80 per cent.

The analytical historic simulation method does not rely upon a single estimated measure of correlation. Rather, implicit temporal correlations are utilised for simulating potential loss scenarios. A sufficiently long look-back period includes periods of extreme volatility and associated breakdown in the long term relationships. The margin calculation is based on an average of extreme simulated tail losses and ensures that the most punitive scenarios relevant to any portfolio over the look-back period are used for estimating the PFE at the portfolio level. The PFE at the product level is measured from the tail loss for each product separately i.e. the non-diversified portfolio loss. The robustness of LCH's portfolio margin methodologies is measured daily through margin erosion and backtesting analysis. Model performance is assessed at member portfolio level, risk factor level and stylised portfolio level. The stylised (hypothetical) portfolios check margin performance for positions that contain a high degree of price dependency such as stylised calendar spreads and relative value positions. Regular sensitivity testing evaluates changes in recent correlations[7].

Key Consideration 6: A CCP should analyse and monitor its model performance and overall margin coverage by conducting rigorous daily backtesting – and at least monthly, and more-frequent where appropriate, sensitivity analysis. A CCP should regularly conduct an assessment of the theoretical and empirical properties of its margin model for all products it clears. In conducting sensitivity analysis of the model's coverage, a CCP should take into account a wide range of parameters and assumptions that reflect possible market conditions, including the most-volatile periods that have been experienced by the markets it serves and extreme changes in the correlations between prices.

Initial margin coverage is backtested on a daily basis by comparing the portfolio initial margin with ex post clean profit and loss. The backtest results are reviewed daily by the LCH risk management function with monthly summaries shared at each LCH Risk Committee. If backtesting suggests the margin coverage target cannot be met, LCH will conduct further investigation into the performance of the margin model. Additional analysis is performed on a monthly basis to investigate underlying causes of margin coverage breaches and identify any model weaknesses with respect to specific products, risk factors and market conditions.

[7] On 10 April 2017 ESMA published an opinion regarding the implementation of portfolio margining requirements for CCPs under Article 27 of EMIR. LCH became compliant with these updated requirements on 30th September 2017.

LCH performs six sensitivity tests for the analytical models and seven tests for the empirical models. The tests for the analytical models examine sensitivities to certain portfolio types, volatility scaling assumptions, risk factor return assumptions, risk factor level dependence, EWMA decay factor sensitivity and correlation changes. The tests for the empirical models examine sensitivities to certain portfolio types, correlation effects and the sensitivities to changes in contract offsets. Tests are performed monthly with quarterly reports made to the risk management function. Potential shortcomings may arise for a number of different reasons such as that the model does not capture all the risk factors, the model is overly procyclical, the model does not respond to new volatility and correlation, the model exhibits excessive ghosting effects, model backtesting breaches are excessive or clustered, or market conditions breach the model assumptions. LCH will call additional margin for portfolios exhibiting excessive margin erosion until the model is updated and performance issues are addressed. Backtesting results by service are disclosed on the LCH website. The results of the sensitivity tests are for internal purposes only and are not disclosed to members or clients.
Key Consideration 7: A CCP should regularly review and validate its margin system. LCH's margin models are validated on an annual basis considering data over the past year. The independent review of margin models considers all available backtesting and stress testing results. In addition, it tests the performance of the models across various levels of confidence, and tests and calibrates the underlying parameters of models. In addition, LCH's risk policies and outcomes are reviewed on a regular basis by the LCH Risk Committee. The model review evaluates the validity of the margin model in theory and its performance in practice, and also appraises its parameters and assumptions. The review considers any changes in market practice and recent market conditions. Material changes to margin methodology are subject to LCH's internal risk governance process, which includes both internal review and independent validation of the model, and must receive approval from both the Executive Risk Committee and the LCH Board. The model validation report and recommendations, for each LCH clearing service, are notified to internal risk governance, the Internal Audit department and to relevant Regulators.

Publicly available resources	Margin Methodologies Risk Management Overview Rulebook Public quantitative disclosure standards for central counterparties

Principle 7: Liquidity risk

An FMI should effectively measure, monitor, and manage its liquidity risk. An FMI should maintain sufficient liquid resources in all relevant currencies to effect same-day and, where appropriate, intraday and multiday settlement of payment obligations 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 liquidity obligation for the FMI in extreme but plausible market conditions.

LCH has robust arrangements for the management of liquidity risk during business-as-usual and in a default situation. An operational liquidity target is set and closely monitored by LCH and stress testing is performed using conservative assumptions, including the default of the two member groups that would generate the largest liquidity need, to determine the adequacy of its liquid resources. LCH does not rely on supplemental liquid resources, or any assumption of the provision of central bank credit, in meeting its stressed liquidity needs.

Key Consideration 1: An FMI should have a robust framework to manage its liquidity risks from its participants, settlement banks, nostro agents, custodian banks, liquidity providers, and other entities.

LCH's framework for the management of liquidity risk is set out in an internal Policy, which is reviewed by the LCH Risk Committee and approved by the LCH Board. The policy sets out the parameters within which liquidity risks must be managed within the CCP, including setting out sources of liquidity and liquidity needs, the nature and frequency of liquidity assessment, limits and stress testing.

The framework is further detailed in a series of underlying detailed procedures, namely:

- A Liquidity Plan
- A Liquidity Testing Procedure
- A Liquidity Stress Testing Procedure

LCH's liquidity policy considers two key sources of liquidity needs, as well as other potential outflows that might further deplete liquidity resources. The two main sources of liquidity needs are

(i) outflows that arise in the normal course of operations (i.e. not due to member default), such as repayment of excess cash upon clearing member request, overall reduction in initial margin resulting from clearing members' reduction or close-out of positions, clearing member request to substitute non-cash collateral for cash collateral or to facilitate settlement (including for settlement fails); and

(ii) the potential liquidity need in the event of clearing member default(s), thereby requiring LCH to

(a) fulfil the settlement obligations of the defaulting clearing member(s) and,

(b) pay variation margin to non-defaulting clearing members on the positions held by the defaulting clearing member(s). There may also be hedging costs and potential losses due to the liquidation of the defaulting clearing member(s) cleared positions and/or collateral lodged with respect to those cleared positions.

The liquidity policy also considers other potential liquidity needs such as those generated by payment delays or disruptions, as well as the failure of an investment counterparty to return cash at the maturity of an investment. Note that in the absence of a clearing member default, cashflows arising from the clearing activity itself are matched across LCH's books.

The size of LCH's liquidity requirement is an aggregate of the sources of liquidity needs which are assessed on a daily and intraday basis. Liquidity risk is managed on a centralised basis taking into consideration the aggregate liquidity needs across all services. In its quarterly PFMI quantitative disclosure, LCH publishes the size and composition of its qualifying liquid resources, and the estimated and actual largest same-day, and where relevant intraday and multiday payment obligation in total.

Clearing members, or their affiliates, may also play roles as custodians, settlement banks or investment counterparties. These exposures are assessed and monitored in accordance with LCH's policies, which set out requirements for intraday monitoring and set limits on exposures to these entities.

Key Consideration 2: An FMI should have effective operational and analytical tools to identify, measure, and monitor its settlement and funding flows on an ongoing and timely basis, including its use of intraday liquidity.

LCH's core banking system contains records and settlement status of all margin, settlement, funding and investment flows. The system is used by the investment management team (Collateral and Liquidity Management, or CaLM) to manage investment activities and intraday settlement.

In addition, the Collateral Operations department tracks liquidity usage using SWIFT reports received from settlement banks to obtain balance information on nostro accounts on a near real-time basis. All accounts at settlement banks, custodians and (I)CSDs are reconciled daily between external statements and the internal LCH record.

An escalation process is in place within LCH to alert senior management to unusual movements.

Key Consideration 3 is not applicable to CCPs.

Key Consideration 4: A CCP should 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. In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should consider maintaining additional liquidity resources sufficient to cover a wider range of potential stress scenarios that should include, but not be limited to, the default of the two participants and their affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions.

As LCH is systemically important in multiple jurisdictions, its liquidity monitoring always considers the liquidity need that would be generated in the event of default of the two largest clearing member groups, including affiliates and investment exposures, in extreme but plausible market conditions, to ensure sufficient liquidity resources are maintained to cover this requirement.

LCH carries out daily liquidity stress tests based on both business as usual and stressed market conditions. LCH models its liquidity out to 30 days to ensure sufficient liquidity to cover ongoing operations. LCH estimates the size of the liquidity requirement in each of EUR, USD and GBP, and in aggregate across all currencies (i.e. those in which it incurs settlements). The model factors in multiple relationships, e.g. when a clearing member is also an investment counterparty. LCH also conducts intraday liquidity stress testing, which models the liquidity impact of investments maturing overnight not being available.

Liquidity needs in all relevant currencies are monitored daily, as part of LCH's liquidity risk management framework.

The results of liquidity stress testing are reported to senior management within LCH's risk and CaLM functions on a daily basis.

Key Consideration 5: For the purpose of meeting its minimum liquid resource requirement, an FMI's qualifying liquid resources in each currency include cash at the central bank of issue and at creditworthy commercial banks, committed lines of credit, committed foreign exchange swaps, and committed repos, as well as highly marketable collateral held in custody and investments that are readily available and convertible into cash with prearranged and highly reliable funding arrangements, even in extreme but plausible market conditions. If an FMI has access to routine credit at the central bank of issue, the FMI may count such access as part of the minimum requirement to the extent it has collateral that is eligible for pledging to (or for conducting other

appropriate forms of transactions with) the relevant central bank. All such resources should be available when needed.

LCH's primary liquid resources consist of cash and highly marketable securities (including those provided by a defaulted member as collateral and received as settlement of the defaulter's cleared positions). The LCH quarterly PFMI quantitative disclosure contains data related to the size and composition of its qualifying liquid resources.

LCH's liquid resources are managed in compliance with its internal investment and liquidity policies to ensure capital preservation and availability of liquidity to meet stressed liquidity requirements. Investments are managed such that maturing investment cash flows each day are sufficient to cover estimated operational needs. A further proportion of the portfolio is maintained in highly liquid government securities that can be sold or used as repo collateral to generate further liquidity as required.

LCH has processes that can be invoked in stressed environments to raise liquidity. These processes make assumptions around some activities which are not utilised in a business as usual environment, and hence care has to be taken to ensure that these assumptions are realistic. To ensure that this is the case, LCH undertakes an exercise of 'War Games' to test the assumptions. These activities test market/counterparty appetite for securities that LCH do not actively invest in or sizes/concentrations of exposures that are outside the day to day activity.

LCH has prearranged funding arrangements in the form of completed GMRA agreements with a number of high quality counterparties, including counterparties with particular expertise and capacity in specific collateral markets. LCH engages in reverse repurchase transactions for investment purposes, and has a regular programme of test repurchase transactions, which are reported through the risk governance process. LCH also has prearranged funding arrangements with major (I)CSDs. For certain currencies, LCH has routine access to central bank facilities, but it does not rely on these facilities

LCH's liquidity policy requires that a minimum buffer be maintained above the stress tested liquidity resource requirement on a cover two basis and remedial action be taken if the buffer is eroded.

Key Consideration 6: An FMI may supplement its qualifying liquid resources with other forms of liquid resources. If the FMI does so, then these liquid resources should be in the form of assets that are likely to be saleable or acceptable as collateral for lines of credit, swaps, or repos on an ad hoc basis following a default, even if this cannot be reliably prearranged or guaranteed in extreme market conditions. Even if an FMI does not have access to routine central bank credit, it should still take account of what collateral is typically accepted by the relevant central bank, as such assets may be more likely to be liquid in stressed circumstances. An FMI should not assume the availability of emergency central bank credit as a part of its liquidity plan.

LCH does not count non-qualifying liquid resources as being available to meet liquidity outflows in its liquidity stress testing. Collateral accepted by LCH as collateral for investments or as non-cash collateral for margin (which can only be used in the event of the default of the member who provided the collateral) is typically acceptable as collateral at the relevant central bank.

LCH does not rely on supplemental liquid resources, or any assumption of the provision of central bank credit, in meeting its stressed liquidity needs.

Key Consideration 7: An FMI should obtain a high degree of confidence, through rigorous due diligence, that each provider of its minimum required qualifying liquid resources, whether a participant of the FMI or an external party, has sufficient information to understand and to manage its associated liquidity risks, and that it has the capacity to perform as required under its commitment. Where relevant to assessing a liquidity provider's performance reliability with respect to a particular currency, a liquidity provider's potential access to credit from the central bank of issue may be taken into account. An FMI should regularly test its procedures for accessing its liquid resources at a liquidity provider.

LCH does not rely on specific liquidity providers to meet its minimum required qualifying liquidity resources as it holds sufficient qualifying resources by way of highly marketable collateral held in custody and investments. This collateral can be readily convertible into cash with prearranged and highly reliable funding arrangements.

LCH carries out appropriate ongoing due diligence on counterparties as required by its Counterparty Credit Risk Policy.

LCH maintains a Liquidity Plan that describes the tools that would be used to fund liquidity to meet operational or default liquidity needs. The plan considers possible constraints on access to each source of liquidity, including whether they would be available during periods of market stress or during a 'liquidity event' (defined as a situation where there is an actual or perceived risk of any cash shortfall). Some of the tools LCH would use to address a liquidity shortfall are applied on an ongoing basis as part of LCH's standard investment and liquidity management activities e.g. maturing investments, and the purchase and sale of securities. To ensure that it could access liquidity through using the tools that are not used on a day-to-day basis (e.g. repo, borrowing, FX swaps), LCH conducts regular 'war games'. As part of these tests, LCH also simulates the liquidation of a defaulting clearing member's collateral.

Key Consideration 8: An FMI with access to central bank accounts, payment services, or securities services should use these services, where practical, to enhance its management of liquidity risk.

LCH's internal risk policy sets a preference for the use of central bank services where available.

Practical considerations are, for example, the existence of policy determinations by the central bank of the currency or local legal frameworks that do not permit access to central bank accounts by CCPs, or else restrict the provision of such accounts to domestic CCPs or those deemed to be systemically important in that jurisdiction.

LCH maintains accounts for concentration and payment services in GBP, EUR, CHF, CAD, NOK and AUD. LCH uses each of the above accounts to facilitate its payment and settlement activity in the relevant currency.

Key Consideration 9: An FMI should determine the amount and regularly test the sufficiency of its liquid resources through rigorous stress testing. An FMI should have clear procedures to report the results of its stress tests to appropriate decision makers at the FMI and to use these results to evaluate the adequacy of and adjust its liquidity risk-management framework. In conducting stress testing, an FMI should consider a wide range of relevant scenarios. 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. Scenarios 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. In all cases, an FMI should document its supporting rationale for, and should have appropriate governance arrangements relating to, the amount and form of total liquid resources it maintains.

LCH carries out daily and intraday liquidity stress testing which compares stress needs for liquidity against the stressed resources available.

Daily reports of the results of such testing are circulated to senior risk management including the Chief Risk Officer. The stress tests take a conservative set of assumptions about potential outflows and the ability of LCH to liquidate assets, and assume the default of the two largest members, along with their affiliates and clients, that have the largest liquidity requirements. In addition to the cover two liquidity stress tests, LCH also runs several additional extreme but plausible stress-test scenarios, which target events that are considered to have a probability of up to once in 30 years. These scenarios model the impact of restricted access to liquid resources due to closure of certain parts of the repo market, the impact of a regional economic crisis and the default of multiple clearing participants. The results of these additional stress tests are used for management information.

The liquidity stress tests take into account liquidity risks arising from the different relationships LCH has with the entities, or members of the same group, and assume that they may simultaneously default in their capacities as clearing member, as investment counterparty, and as Settlement bank or custodian. LCH's stress testing seeks to ensure that it is able to settle its payment obligations on time in this circumstance. As part of the quarterly liquidity reverse stress testing scenario suite, both the availability of the liquid assets and the size of the liquid liabilities are stressed in different ways to determine whether it would be plausible to be left with a liquidity deficit (i.e. the Liquidity Coverage Ratio is under 100%).

The Liquidity Risk Policy and liquidity plan are reviewed annually with any changes reviewed and approved by the Risk Committee and the LCH Board. The liquidity risk management framework is subject to independent validation annually.

Key Consideration 10: An FMI should establish explicit rules and procedures that enable the FMI to effect same-day and, where appropriate, intraday and multiday settlement of payment obligations on time following any individual or combined default among its participants. These rules and procedures should address unforeseen and potentially uncovered liquidity shortfalls and should aim to avoid unwinding, revoking, or delaying the same-day settlement of payment obligations. These rules and procedures should also indicate the FMI's process to replenish any liquidity resources it may employ during a stress event, so that it can continue to operate in a safe and sound manner.

The key tests used to determine the liquidity requirement in the event of a member default are the intraday liquidity stress test and 30-day liquidity stress test, which forecasts liquidity requirements that arise over the next 30 business days under stressed market conditions and assuming the default of the two member groups with the largest liquidity requirements. To ensure it maintains sufficient liquid resources, the Liquidity Risk Policy requires LCH maintain a minimum liquidity buffer above its total liquidity requirement. This ensures that the CCP has sufficient liquidity to meet intraday and daily liquidity needs following the default of the two clearing members (with their affiliates and clients) with the largest liquidity requirements. The actions that LCH would take to address uncovered liquidity shortfall or replenish its liquidity resources are described in the Liquidity Plan and Recovery Plan. The Liquidity Plan covers the tools that could be used to fund operational and default liquidity needs. LCH typically holds a substantial buffer of liquid resources in excess of its liquidity coverage ratio (LCR) required to meet the projected operational and default liquidity requirement. The Liquidity Plan and the Recovery Plan consider possible constraints on access to each source of liquidity, including whether they would be available during periods of market stress or during a 'liquidity event' (defined as a situation where is an actual or perceived risk of any cash shortfall). LCH incorporates restricted access to liquidity sources in its liquidity stress testing.

Publicly available resources	Rulebook Public quantitative disclosure standards for central counterparties

LCH The Markets' Partner

Principle 8: Settlement Finality

An FMI should provide clear and certain final settlement, at a minimum by the end of the value date. Where necessary or preferable, an FMI should provide final settlement intraday or in real time.

LCH's arrangements for ensuring settlement finality are founded on the designation of LCH under the UK Settlement Finality Regulations 1999; LCH Rulebook provisions; and the commissioning of legal opinions in support of the applicable provisions within its Rulebook.

Key Consideration 1: An FMI's rules and procedures should clearly define the point at which settlement is final.

Cash settlements occur via LCH's proprietary direct debit system, the Protected Payments System (PPS), and Settlement Services Providers, as referred to in the LCH Settlement Finality Regulations.. For more information on PPS see *Principle 9*. Securities settlements occur via Securities Systems Operators, as referred to in the LCH Settlement Finality Regulations.

The conditions under which settlement obligations in respect of registered contracts are final and irrevocable are set out in the Settlement Finality Regulations section of the publicly available LCH Rulebook. Under LCH's Settlement Finality Regulations:

- a Payment Transfer Order becomes irrevocable once the PPS bank, Member Settlement Bank, Concentration or central bank or Settlement Services Provider, as applicable, has confirmed the commitment via SWIFT message or otherwise confirms that such payment will be made; and
- a Securities Transfer Order becomes irrevocable at the time prescribed by that Securities System Operator.

The legal basis for the framework with respect to settlement finality is found in the LCH Rulebook along with the legal agreements between LCH and its clearing members or Settlement Service Providers. This framework is supported by:

- the designation of LCH, including the PPS, under the *UK Financial Markets and Insolvency (Settlement Finality) Regulations 1999*, which implements *Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems (the Settlement Finality Directive)*. The Settlement Finality Directive aims to reduce the risks associated with participation in payment and securities settlement systems by minimising the disruption that may be caused by insolvency proceedings brought against a participant in such a system; and
- Legal opinions commissioned by LCH that seek to confirm that the LCH Settlement Finality Regulations (which form part of the Rulebook) are enforceable. These legal opinions are published on the LCH website.

LCH performs its securities settlement with linked FMIs, such that LCH makes its payments and deliveries only after settlement has been confirmed on opposite and equivalent payments or deliveries.

Key Consideration 2: An FMI should complete final settlement no later than the end of the value date, and preferably intraday or in real time, to reduce settlement risk. An LVPS or SSS should consider adopting RTGS or multiple-batch processing during the settlement day.

With regards to LCH's operation of the PPS all currencies are final and irrevocable on the value date. For some currencies this will be same-day settlement (i.e. settled on the day of the instruction).

Clearing members are required to have both primary and contingency arrangements with PPS banks for each currency in which settlement is incurred.

With respect to settlement via a Settlement Services Provider, settlement shall be complete upon the earlier of the settlement of all Payment Transfer Orders to the relevant Settlement Services Provider

together having the effect on the given settlement date of reducing the balance on a cash account provided by the Settlement Services Provider to zero or the end of the given business day. The Settlement Finality Regulations within the LCH Rulebook do not provide for deferral of cash nor securities settlement. Deferral of payment or settlement could lead to member default, in accordance with the LCH Rulebook. When LCH makes intraday calls (please see *Principle 6*) settlement must take place within an hour of the call being issued.	
Key Consideration 3: An FMI should clearly define the point after which unsettled payments, transfer instructions, or other obligations may not be revoked by a participant. The Settlement Finality Regulations within the LCH Rulebook are supported by the designation of LCH under the *UK Financial Markets and Insolvency (Settlement Finality) Regulations 1999,* which implements *Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems* (the Settlement Finality Directive). The Settlement Finality Directive aims to reduce the risks associated with participation in EU payment and securities settlement systems by minimising the disruption that may be caused by insolvency proceedings brought against a participant in such a system. LCH's Settlement Finality Regulations specify the times after which Payment Transfer Orders are irrevocable. The LCH Rulebook specifies that a member's cash settlement obligation due to LCH via PPS is not deemed to have been satisfied when funds have been transferred from the member's account at the PPS Bank to the LCH account at the PPS bank, but only when funds have been transferred from the LCH account at the PPS Bank to the LCH account at LCH's concentration bank, and any time permitted for the recall of any such payment in the relevant payment system has expired. The initial transfer of funds from the member's account at the PPS Bank to the LCH account at the PPS bank will always be preceded by a payment confirmation from the PPS bank to LCH that such funds will be transferred to LCH. Once such a confirmation has been received by LCH this payment can no longer be revoked by the PPS bank. Before this time an unsettled payment could only be revoked by LCH; any other revocation could potentially lead to a clearing member being served with a Default Notice. Securities Systems Operators prescribe when securities settlement obligations have been satisfied. Should a Securities Systems Operator alter its prescribed settlement time LCH will support this. Non-cash settlement cancellations could be made subject to the Settlement Systems Operator's rules and prescribed cut-off times. The LCH Rulebook, including LCH's Settlement Finality Regulations, is publicly disclosed on the LCH website.	
Publicly available resources	Rulebook

Principle 9: Money Settlements

An FMI should conduct its money settlements in central bank money where practical and available. If central bank money is not used, an FMI should minimise and strictly control the credit and liquidity risk arising from the use of commercial bank money.

LCH uses central bank money for settlement purposes where available and practicable. Where commercial banks are utilised, LCH has contractual arrangements in place through legal agreements and its Rulebook provisions, to minimise incurring credit risk. Supporting operational procedures and processes are also designed to mitigate credit and liquidity risk.

Key Consideration 1: An FMI should conduct its money settlements in central bank money, where practicable and available, to avoid credit and liquidity risks.

LCH operates the PPS[8] for the transfer of funds to and from clearing members. The PPS is overseen by the Bank of England as a Recognised Payment System under the Banking Act 2009. The PPS operates within the legal framework of the PPS Agreements between LCH and the PPS Banks. There are separate PPS Agreements covering each jurisdiction where the PPS operates (i.e. the UK,USA and Australia) in order to support extended clearing hours.

A clearing member must complete a PPS mandate for each PPS Bank where it maintains PPS accounts. A clearing member is required to maintain a UK PPS bank account for GBP, a US PPS bank account for USD, and is also required to maintain a PPS Bank account for each currency in which it incurs settlement at one of the participating PPS banks.

Settlement is over accounts at each participating PPS bank between accounts maintained by the clearing member and those maintained by LCH. PPS banks then make (or receive) payment to/from the LCH concentration bank via the relevant Large Value Payment System (LVPS) for the particular currency. Note that any payment to or from the concentration bank represents the net position against LCH of all the clearing members that use a given PPS bank[9].

LCH's internal risk policies set a preference for the use of central bank services for concentration accounts where available. Practical considerations are, for example, the existence of policy determinations by the central bank of the currency or local legal frameworks that do not permit access to central bank accounts by CCPs, or else restrict the provision of such accounts to domestic CCPs or those deemed to be systemically important in that jurisdiction.

LCH maintains central bank accounts for concentration purposes in Pounds Sterling, Euros, Canadian dollars, Australian dollars, Norwegian Kroner and Swiss Francs. Commercial banks are utilised as concentration banks for United States dollars and other currencies where central bank accounts are not available. Commercial concentration banks are subject to specific credit and operational criteria as laid out in LCH's internal risk policies.

Key Consideration 2: If central bank money is not used, an FMI should conduct its money settlements using a settlement asset with little or no credit or liquidity risk.

The rules governing the PPS ensure that LCH does not have credit exposure to PPS banks. A clearing member's obligation to LCH is only deemed satisfied once funds have been transferred from the PPS bank to the concentration bank of LCH and any time permitted by the relevant payment system has expired for the recall of any such payment (i.e. the payment could no longer be revoked). This means that a clearing member remains responsible for the obligation in the event of the PPS bank's failure. LCH's credit exposure to a commercial concentration bank ceases once the funds are transferred by the concentration bank to another entity in accordance with LCH's instructions.

8 LCH's proprietary Protected Payments System.

9 For example, consider a PPS bank that acts on behalf of just two clearing members. If one clearing member is owed $1 from LCH, and the other clearing member owes $1 to LCH, there will be no payment from the PPS bank to the concentration bank.

LCH sets out criteria for banks operating or applying to operate the PPS, which include:

- A minimum Internal Credit Score (ICS) calculated in accordance with and as required by LCH's internal risk policies;
- Operational requirements around accounting and SWIFT messaging; and
- Adherence to LCH procedures and the terms and conditions of the PPS Agreement.

LCH reserves the right to apply more stringent criteria when, in its assessment, a PPS bank's financial resources or operational capability are not commensurate with its level of business. PPS banks that fail to meet the criteria or have been downgraded are required to leave the service.

Key Consideration 3: If an FMI settles in commercial bank money, it should monitor, manage, and limit its credit and liquidity risks arising from the commercial settlement banks. In particular, an FMI should establish and monitor adherence to strict criteria for its settlement banks that take account of, among other things, their regulation and supervision, creditworthiness, capitalisation, access to liquidity, and operational reliability. An FMI should also monitor and manage the concentration of credit and liquidity exposures to its commercial settlement banks.

LCH calculates an ICS for each of its PPS and concentration banks. The score is calculated using quantitative and qualitative factors that include creditworthiness and capitalisation, the bank's regulation, supervision, access to liquidity and operational reliability. Each PPS bank's rating is subject to a formal assessment at least once per year. Other factors are taken into account during the wider on-boarding process.

Under the PPS Agreements, LCH may undertake regular due diligence of a PPS bank and a PPS bank agrees to meet with LCH at least once per calendar year to formally review the service.

LCH's risk management policies set the standards for the selection of PPS and concentration banks, and monitoring of exposures that arise from PPS and concentration bank activities on a daily (and where appropriate, intraday) basis.

LCH has monitoring processes in place to assess the potential losses it and its participants face, and the liquidity pressures if there is a failure at one of its settlement banks. LCH considers the risk of potential losses is mitigated through its Rulebook provisions which have the effect that a member remains liable for any amount due to LCH until such amounts have been transferred by the PPS bank to LCH's concentration account(s) (or paid out to another member using the same PPS bank). This risk is further mitigated for LCH and its participants, through the PPS agreements which specify that transfers to LCH concentration bank accounts shall be made within two hours of instruction, and LCH's procedures to 'shape' payment flows to avoid build up of material exposures. Additionally, LCH sets unsecured exposure limits for commercial concentration banks, which are monitored intraday and capped to 75 percent of LCH's capital base.

Key Consideration 4: If an FMI conducts money settlements on its own books, it should minimise and strictly control its credit and liquidity risks.

LCH does not conduct money settlements on its own books.

Key Consideration 5: An FMI's legal agreements with any settlement banks should state clearly when transfers on the books of individual settlement banks are expected to occur, that transfers are to be final when effected, and that funds received should be transferable as soon as possible, at a minimum by the end of the day and ideally intraday, in order to enable the FMI and its participants to manage credit and liquidity risks.

LCH executes a standardised set of binding terms and conditions with the commercial banks that participate in the UK, US or Australia PPS, i.e. the PPS Agreement. The PPS Agreement requires that the PPS Bank confirm payments to LCH and, that such payments confirmation occur within specified time limits. Following payment confirmation, payments in respect of margin calls must be credited to the LCH Account no later than such times as set out in the PPS Agreement, i.e. by 9:00am (London time) on the relevant value day or within one hour for intraday calls with a same day value date. The PPS Agreement

also requires that Concentration Transfers take place within two hours of receipt by the PPS Bank of the LCH instruction to concentrate funds.	
Publicly available resources	PPS Arrangements PPS Concentration Activities

Principle 10: Physical deliveries

An FMI should clearly state its obligations with respect to the delivery of physical instruments or commodities and should identify, monitor and manage the risks associated with such physical deliveries.

The LCH Rulebook governs and sets out the overall obligations and responsibilities of all market participants clearing physically delivered instruments (bonds and equities) through LCH. LCH does not offer to store physically delivered instruments or commodities. LCH manages the delivery cycle for all physically delivered instruments and commodities in accordance with its publicly available Rulebook.

Key Consideration 1: An FMI's rules should clearly state its obligations with respect to the delivery of physical instruments or commodities.

LCH supports physical delivery for the Listed Rates, LSEDM, EquityClear and RepoClear clearing services.

The overall obligations and responsibilities that govern physical delivery are publicly defined in the respective Exchange and LCH Rulebooks. In the case of LCH these are set out in its Rulebook and include both the rights and obligations for all market participants as well as how the physical delivery process is administered. Moreover, LCH does not offer to store physically delivered instruments or commodities.

For the RepoClear service, LCH, is a member of both Euroclear Bank and Clearstream Banking Luxembourg's optional Autoborrow schemes providing an additional mechanism to facilitate settlement.

In respects of Gilts and Bonds, LCH allocates delivery via an algorithm. In all cases the seller selects what they intend to deliver. The process is specified within the exchange's publicly available Rulebook. LCH's Rulebook defines the delivery process with respect to cleared transactions.

LCH sends settlement instructions to (I)CSDs and Target 2 Securities (T2S) for transactions between LCH and its clearing members. These are settled under the rules and procedures of the (I)CSD. LCH supports its clearing members by ensuring that they have a strong understanding of their obligations and the procedures for physical delivery and that they are adequately supported throughout the delivery process.

The membership requirements for new clearing members set out the technical and operational obligations, including for physical delivery that they must meet as part of their membership of LCH and the relevant clearing service. Finally, LCH provides training to new clearing members on the physical delivery process, LCH's systems and their obligations.

Existing clearing members, as part of the annual member survey, are asked to provide information on their ongoing technical and operational capacity, including for physical delivery. In addition, LCH provides a rolling schedule of training courses to all clearing members, which includes physical delivery, enabling them to train their staff. Any clearing member can request additional training at any time. LCH further supports its clearing members by making the clearing member test environment available such that they can test their procedures, processes and reconciliations and so that clearing members can familiarise themselves with its systems.

Finally, LCH is available to assist clearing members with either practical, operational or procedural questions associated with the delivery process.

Key Consideration 2: An FMI should identify, monitor, and manage the risks and costs associated with the storage and delivery of physical instruments or commodities.

LCH does not offer to store physically delivered instruments or commodities. LCH manages the delivery cycle for all physically delivered instruments in accordance with its publicly available Rulebook. As part of this management cycle the risk and costs are primarily associated with the position management process and ensuring that a delivery is made in accordance with the contract specifications.

For those physical instruments that settle in an (I)CSD or via T2S, it is the (I)CSD that is responsible for administering the delivery process as well as the application of any associated fees to the (I)CSD

participant. LCH has procedures that are designed to actively position manage trades through to delivery. LCH provides automated position reporting to its clearing members to enable them to accurately monitor their obligations, to allow them to ensure they have the necessary inventory to fulfil their obligation. For the RepoClear service, LCH is a member of both Euroclear Bank and Clearstream Banking Luxembourg's Autoborrow schemes, providing an additional mechanism to facilitate settlement. In certain cases, LCH operates an active fails management process, which will ultimately see failed deliveries being added to the following day's delivery obligations for the respective member. LCH employs a fails fee regime in accordance with Article 15 of the Short Selling Regulation (Regulation (EU) 236/2012) for cash equities. In addition, and in accordance with the LCH Rulebook, LCH also employs a fails fee covering fixed income. In order to maintain efficient and effective delivery processes, LCH regularly reviews delivery amounts against the obligations of its clearing members to ensure that any risks are identified immediately in order to maintain a robust position management process. Finally, LCH ensures its ongoing compliance with international sanctions, including with respect to the potential impacts to the delivery process. In order to ensure that LCH's clearing members have the necessary systems and resources available to them, LCH sets transparent membership criteria requiring technology, operations and resources are in place prior to the member joining LCH and throughout their membership. In addition, LCH requires its clearing members to complete Static Data forms accurately and on a timely basis to ensure their delivery preferences are met.	
Publicly available resources	Rulebook Fixed Income Cash Equities

Principle 11 (Central securities depositories) is not applicable to CCPs.

Principle 12 (Exchange-of-value settlement systems) is not applicable to LCH.

LCH does not operate an exchange-of-value settlement system and therefore does not complete a self-assessment for **Principle 12** (Exchange-of-value settlement systems).

For products that involve the delivery of securities against cash (EquityClear, LSEDM, Listed Rates and RepoClear), LCH is a counterparty to the transaction. Each delivery is instructed between LCH's account at the relevant (I)CSD and the member's at that (I)CSD. LCH only uses (I)CSDs that offer Delivery versus Payment in their exchange-of-value settlement system.

In respect of these services, LCH does not offer to act as custodian for clearing members and settlement is effected only at the (I)CSD, not across LCH's own books. LCH does not, therefore, consider that it operates an exchange-of-value settlement system itself.

LCH The Markets' Partner

Principle 13: Participant-default rules and procedures

An FMI should have effective and clearly defined rules and procedures to manage a participant default. These rules and procedures should be designed to ensure that the FMI can take timely action to contain losses and liquidity pressures and continue to meet its obligations.

The LCH Rulebook contains default rule provisions that set out LCH's rights and obligations in the event of a clearing member default. It also contains provisions in relation to the management of the defaulter's positions and the allocation of losses.

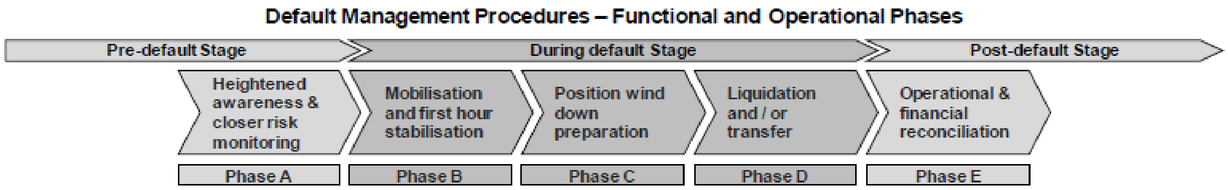
Key Consideration 1: An FMI should have default rules and procedures that enable the FMI to continue to meet its obligations in the event of a participant default and that address the replenishment of resources following a default.

LCH's Default Rules, contained in its Rulebook, set out that it is entitled to place a clearing member in default if it appears to LCH that the clearing member is unable, or is likely to become unable, to meet its obligations in respect of one or more contracts. The Default Rules also set out a non-exhaustive list of events which may show that a clearing member is or is likely to become unable to meet its obligations. LCH may (by circular to clearing members) specify criteria according to which an Automatic Early Termination Event will occur in respect of a clearing member if it becomes subject to any insolvency event.

The Default Rules set out the steps that LCH may take in respect of a defaulter, including entering into contracts to hedge market risk, selling any security, porting client accounts of that clearing member to another clearing member, auctioning the defaulter's proprietary portfolio to other clearing members (to include any client accounts of that clearing member which could not be ported to another clearing member), otherwise closing out any open contracts, and generally taking such action as LCH may deem necessary for its protection. The sequence of actions will be determined by a number of factors, including size and characteristics of the defaulted member's portfolio and the market environment.

Subject to the obligation under EMIR to trigger the procedures for the transfer of the assets and positions held by the defaulting clearing member for the account of its clients to another clearing member, LCH has full discretion over the taking of these steps. All significant decisions will be taken by the LCH CEO or CRO.

The functional and operational phases of default management can be shown as follows:



On calling a default, the LCH CEO will convene the Default Crisis Management Team (DCMT) which will be responsible for the overall management of the default. All LCH clearing services have a Default Management Process (DMP) and a Default Fund Supplement annexed to the Default Rules. The DCMT will instruct the head of each impacted clearing service to convene a Default Management Group (DMG), which comprises LCH executives and, for some services, clearing members. Where representatives of clearing members are seconded to a DMG of LCH for the purpose of default management, they act on behalf of LCH and appropriate confidentiality arrangements are in place. The DCMT will delegate decision making within prescribed limits to the DMG. All significant decisions will be referred to the DCMT for approval. The Default Rules set out how LCH shall meet any losses arising from a default, including the use of collateral provided by the defaulter, LCH's own funds and the default fund(s).

The non-defaulting members are incentivised to participate in the DMP and in auctions to safeguard their own default fund contributions and to ensure the continued operation of the markets.

The Default Rules also set out the order in which LCH shall reduce or bear its losses. In the first instance, losses are met by applying any collateral provided by the defaulter and then by recourse to the defaulter's contribution to the default fund(s). If those are exhausted then further losses are met by payment from LCH's own funds of an amount determined by LCH in accordance with the requirements relating to the calculation and the setting aside of dedicated own resources under the Own Resources Provision of the Default Rules. Thereafter losses are met by recourse to the indemnities given by clearing members other than the defaulter in respect of each default fund(s) to which it has contributed. The amount of such indemnity is limited to an aggregate amount not exceeding the amount of the non-defaulting clearing member's contribution to the default fund(s) in respect of such business type.

If 25 percent of the relevant default fund is used up in managing the default, LCH has the right to call additional funds from non-defaulting service clearing members ('unfunded contributions' or 'assessments'). The value of unfunded contributions LCH may call from each service clearing member in respect of a given default is capped at an amount equal to that clearing member's funded contribution to the relevant default fund at the time of the default.

Should all funded and unfunded resources available to LCH be exhausted, a service continuity phase will be implemented. In this phase clearing members of ForexClear and SwapClear and Listed Rates[10] will be subject to variation margin gain haircutting and clearing members of Commodities, EquityClear, Listed Rates and RepoClear will be subject to a loss distribution charge.

On successful completion of the default management process, a 30 day cooling-off period is triggered. If the default fund has fallen below the floor level, clearing members must restore the default funds to their respective floor levels within two days, with the complete replenishment taking place at the end of the cooling off period.

If another default occurs within the 30-day cooling off period, the DMP will be implemented again and the replenishment will be cancelled; accordingly, service clearing members would be obliged to pay further unfunded contributions called on the new default and participate in the loss distribution process if applicable. Such further unfunded contributions are again capped at an amount equal to each clearing member's funded contribution to the relevant default fund at the time of the (second) default.

Unfunded contributions may not be called by LCH in regard to more than three defaults in any six month period.

LCH will continue to stress test the service default funds as usual throughout the DMP and during the 30 day cooling-off period. If any service clearing member's stress-test losses above margin exceed 45 percent of the remaining default fund, LCH will call for additional margin from those clearing members to cover the excess uncovered stress-test losses above that threshold. Clearing members with weaker credit scores are subject to lower thresholds.

Key Consideration 2: An FMI should be well prepared to implement its default rules and procedures, including any appropriate discretionary procedures provided for in its rules.

There are a number of levels of documentation and procedures that support the DMP. These detail the standards which must be met in dealing with the default of a clearing member, and provide guidance for each service on how to define and implement the default management process. In addition, the guidance describes the high level strategy, principles, standards, ownership and governance at the CCP and service level. Also included are details of the step-by-step processes and procedures at the service level for managing a default.

Throughout these documents, roles and responsibilities are clearly detailed. All areas are resourced to ensure that business as usual activity can be managed alongside a default event.

In the event of a potential or actual default, the DCMT will be convened. The key responsibility of this team is to ensure that all key aspects of the default management procedures are followed, including

[10] The SwapClear and Listed Rates service share a default fund: the Rates Derivatives Default Fund which is split into two margin classes (OTC Rates and Listed Rates). Depending on the activity of the clearing member which defaults, either the clearing members of SwapClear or Listed Rates are juniorised in the default waterfall.

communication plans, the calling of the DMGs and monitoring DMG progress. Each department responsible for communicating to the various stakeholders is represented in the teams and has procedures to support the process. The documentation supporting the DMP is updated on an annual basis (or more frequently if required) and they are formally reviewed and signed off by the Risk Executive. The default management procedures for each service are also reviewed at least annually. LCH's preparations for implementation of the DMP are enhanced by regular fire drills as described further under Key Consideration 4. The Default Notice which LCH will issue to a defaulting clearing member is publicly disclosed on the LCH website.	
Key Consideration 3: An FMI should publicly disclose key aspects of its default rules and procedures. LCH's Default Rules are contained in its Rulebook, which is publicly available on its website. These set out the circumstances in which a clearing member may be declared to be in default and the actions that LCH may take in respect of that default, including the constitution of the relevant DMGs.	
Key Consideration 4: An FMI should involve its participants and other stakeholders in the testing and review of the FMI's default procedures, including any close-out procedures. Such testing and review should be conducted at least annually or following material changes to the rules and procedures to ensure that they are practical and effective. All LCH clearing services involve external participants (such as clearing members, execution brokers etc), as required, in their default management fire drills. For some services (notably those serving the OTC markets), the DMGs have representatives from clearing member firms and they are consulted on changes to the default management procedures. A Group-wide (i.e. all CCPs and services within the LCH Group) default management fire drill takes place at least annually and more frequently if there are substantive changes to process which mean that further testing is required. In addition, service-specific tests are held as and when required, for example if there are changes to rules and procedures within that service. Such tests may include external participants who would be involved in the DMP. Each external participant rehearses their role in an actual default event. For example a broker will be given orders to simulate hedging or liquidation of positions, and clearing members will participate in the DMG to review a synthetic portfolio, recommend hedging and liquidation strategies and submit bids in a dummy auction. Following a fire drill test a report is produced that evaluates the exercise and identifies areas for improvement and change. The reports are shared with the Audit Committee and regulators following internal review. Each fire drill has specific objectives to ensure that all aspects of default management are covered by the range of different tests performed. Some tests include external clearing members; others seek to test internal routines or close-out assumptions and procedures. The Group-wide fire drills generally cover the scenario of a clearing member defaulting across all CCPs and services simultaneously. Scenarios may be introduced where the defaulting entity also acts as a counterparty of a different type (for example payment agent or investment counterparty). A Group Default Crisis Management Team (Group DCMT) is convened in the event of both a Group-wide fire drill and for a real default. Its role is to consider coordination opportunities and offer advice to the LCH Group CCP DCMTs, but has no decision making role. Firedrills may be coordinated with other major CCPs in order to test the ability of clearing members to provide staff to more than one CCP DMG at the same time, which more realistically simulates the default of an institution which has exposures at multiple clearing houses.	
Publicly available resources	Rulebook

	Default Waterfall Risk Management Overview Public quantitative disclosure standards for central counterparties

Principle 14: Segregation and portability

A CCP should have rules and procedures that enable the segregation and portability of positions of a participant's customers and the collateral provided to the CCP with respect to those positions.

LCH offers two models of client segregation arrangements, to meet the regulatory requirements of each jurisdiction in which it is authorised, and maintains its books and records, and segregated accounts where relevant, in accordance with those requirements. Individually segregated client accounts are available as well as omnibus client accounts. LCH provides, in addition, for services where it is regulated by the CFTC, client segregation arrangements in order to satisfy US requirements. LCH's Rulebook sets out the rules of segregation and portability for each model.

Key Consideration 1: A CCP should, at a minimum, have segregation and portability arrangements that effectively protect a participant's customers' positions and related collateral from the default or insolvency of that participant. If the CCP additionally offers protection of such customer positions and collateral against the concurrent default of the participant and a fellow customer, the CCP should take steps to ensure that such protection is effective.

LCH offers segregation arrangements to meet the regulatory requirements of each jurisdiction in which it is authorised. LCH is required to segregate clearing member client positions and collateral (including affiliates' positions and collateral) from clearing member proprietary business in all markets, including cash markets.

Individual segregation means that LCH records positions, margin requirements and collateral delivered by a clearing member for a specific client against an account that is exclusive to that client, and which is not exposed to losses on any other client or member accounts.

LCH also offers various models of omnibus client segregation, in which clients' positions, margin requirements and collateral are pooled, to different extents, although they are never commingled in LCH's books with positions and collateral of the clearing members' proprietary accounts.

For clients of US Futures Commission Merchants (FCMs), LCH offers segregation models meeting CFTC requirements in relation to Cleared Swaps. This is a legally segregated, operationally commingled (LSOC) model in which clients have additional legal protections against fellow client risk.

Specific provisions apply in respect of FCM's clients' positions and collateral in the event of default. For all other members, positions and collateral in client accounts can be transferred (i.e. ported) to accounts at other clearing members on the instruction of the client(s) as long as the receiving clearing member consents. In the majority of cases the backup clearing member would have been chosen in advance of the member defaulting. If this is not the case, a client may appoint the backup clearing member at the time of the default. Porting will only be possible if the backup clearing member accepts the ported contracts. Depending on the type of account it may be necessary for all the clients in that account to agree to port to the same clearing member. LCH encourages clients to pre-arrange alternative clearing members in order to expedite the porting process; in some cases clients maintain multiple active clearing relationships.

Positions held in FCMs' clients' accounts would be dealt with, to the extent possible, in accordance with the instructions of the relevant client, although the action taken must be with the approval of the authorities. The client could request that its positions be closed out or ported. Positions and collateral in FCMs' client accounts can generally be ported upon the default of the FCM clearing member provided that, among other conditions, the collateral held in the account versus the collateral requirement on LCH's books is not subject to a deficit and the CFTC does not object to the transfer upon notice. In the event of an FCM clearing member default, LCH will attempt to port positions and collateral in client accounts to a solvent FCM clearing member that is able and willing to accept the positions and collateral. A transfer of this nature, including collateral, would take place upon receipt of non-objection from the CFTC, agreement with the FCM's bankruptcy trustee and after approval by the US Bankruptcy Court.

Within the EU, national implementations of the Settlement Finality Directive (SFD) protect certain actions pursuant to the default rules of LCH as it has been designated under the SFD. A more detailed description of the legal aspects of LCH's activity can be found at the discussion on Principle 1 (*Legal basis*).

LCH obtains a legal opinion from a reputable legal firm located in the jurisdiction in which each clearing member is incorporated before accepting a clearing member from that jurisdiction. This legal opinion seeks to establish, with a high degree of confidence, that there is domestic legislation in place that protects and supports provisions within LCH's Rulebook with respect to porting of client positions and collateral from challenge under domestic insolvency law. Where it is unclear, or such legislation is not in place, LCH requires that the clearing member execute a security deed, provided it has established via the legal opinion that the security deed is effective and enforceable in the jurisdiction of the clearing member.

Key Consideration 2: A CCP should employ an account structure that enables it readily to identify positions of a participant's customers and to segregate related collateral. A CCP should maintain customer positions and collateral in individual customer accounts or in omnibus customer accounts.

As described above, LCH segregates clients' positions and collateral in its own books and records, and offers both individual and omnibus levels of segregation. For FCMs' clients, collateral is also physically segregated from clearing members' proprietary collateral as required under CFTC Regulations Parts 1 and 22.

Collateral supporting clients' positions covers initial and contingent margin, including margin add-ons (for credit risk, concentrated positions and other risks), as well as any excess collateral that clearing members may choose to post to the CCP for their client accounts.

LCH relies on clearing members providing correct information about new transactions, positions and collateral relating to each client at the time that the member submits the transaction for registration or lodges the collateral. LCH maintains a separate record of the actual collateral provided in respect of each client individually segregated account; whereas in omnibus accounts LCH allocates collateral to each customer on a value basis. Collateral in respect of omnibus client accounts can be called on a net or gross basis depending on the account type.

In an individually segregated account, a client's collateral is fully protected from fellow client risk. In other types of accounts there are varying degrees of protection from fellow client risk. The omnibus structure will generally provide for a mutualisation of losses and a pooling of risk between the clients in the relevant account.

Key Consideration 3: A CCP should structure its portability arrangements in a way that makes it highly likely that the positions and collateral of a defaulting participant's customers will be transferred to one or more other participants.

LCH offers all known clients of a defaulting clearing member the opportunity to port to a new clearing member. The chances of successful porting depend on the segregation model selected by the client and the extent to which the client has pre-arranged a back-up clearing member, or can arrange one quickly after the default. Except in conditions of severe margin erosion on the client account, LCH allows a minimum of 24 hours after a default for the defaulting clearing member's clients to identify and authorise a replacement clearing member.

The LCH Rulebook contains provisions in its Default Rules with respect to obtaining consent from clearing members to which positions and collateral are to be ported, where an individual segregated account clearing client or an individual omnibus gross segregated clearing client has appointed a backup clearing member. The Rulebook also sets out that in the event of a default LCH will publish the deadline by which written consent must be received from a client in order for LCH to seek to port.

Once the porting is effected, the new clearing member will be called for any shortfall in margin cover (for example, in relation to positions that lost money between the default and the port).

Key Consideration 4: A CCP should disclose its rules, policies, and procedures relating to the segregation and portability of a participant's customers' positions and related collateral. In particular, the CCP should disclose whether customer collateral is protected on an individual or

omnibus basis. In addition, a CCP should disclose any constraints, such as legal or operational constraints, that may impair its ability to segregate or port a participant's customers' positions and related collateral. LCH makes public disclosures in accordance with Article 39(7) of EMIR, including the basis on which collateral is protected in the different segregation models, for both its general and FCM models. The risks and uncertainties associated with the CCP's segregation and portability arrangements are disclosed in the Article 39(7) disclosure described above. Costs for different types of accounts are disclosed on the LCH website.	
Publicly available resources	Rulebook Collateral Service Description LCH Account Structures under EMIR Public quantitative disclosure standards for central counterparties

Principle 15: General business risk

An FMI should identify, monitor, and manage its general business risk and hold sufficient liquid net assets funded by equity to cover potential general business losses so that it can continue operations and services as a going concern if those losses materialise. Further, liquid net assets should at all times be sufficient to ensure a recovery or orderly wind-down of critical operations and services.

General business risk is one of the risks considered within the risk management framework. To assess this risk consideration is given to key drivers, both with and without financial impact-reducing mitigants. These drivers are monitored quarterly and subject to the governance process. Accordingly LCH holds liquid net assets funded by equity and has developed both a Recovery Plan and a Wind-down Plan which are approved by the LCH Board and subject to review at least annually or following material changes.

Key Consideration 1: An FMI should have robust management and control systems to identify, monitor, and manage general business risks, including losses from poor execution of business strategy, negative cash flows, or unexpected and excessively large operating expenses.

LCH identifies its business risks by considering the general business conditions which are likely to impair its financial position as a consequence of decline in its revenues or an increase in its expenses resulting in a loss that must be charged against its capital. Examples of reasonable foreseeable drivers of business risk for LCH include cost overruns (including project overspends), impacts of competition on its revenue, volume and mix of collateral held, regulatory change and foreign exchange exposure.

In order to identify the specific business risks it faces, LCH identifies the drivers of business risk, reviews its existing control framework and quantifies the potential financial impact of reasonably foreseeable adverse loss events. Business risk drivers are considered both with and without financial impact-reducing mitigants in place. Business drivers are also considered for potential impact of simultaneous occurrence.

LCH faces business risks related to higher than expected costs and lower than expected revenues. This would include impact of increased competition in clearing and timing of clearing mandates for products currently cleared by LCH.

The drivers of business risk are monitored throughout the year, and a detailed calculation is performed once a year or on a significant change to the business. Business risk is reported to the LCH Board.

Key Consideration 2: An FMI should hold liquid net assets funded by equity (such as common stock, disclosed reserves, or other retained earnings) so that it can continue operations and services as a going concern if it incurs general business losses. The amount of liquid net assets funded by equity an FMI should hold should be determined by its general business risk profile and the length of time required to achieve a recovery or orderly wind-down, as appropriate, of its critical operations and services if such action is taken.

LCH holds liquid net assets funded by equity so that it can continue operations and services as an ongoing concern if it incurs general business losses. LCH's agreed minimum regulatory capital requirement includes a specific provision for business risk, which must be at a minimum equal to three months' operating expenses.

LCH maintains a Wind Down Plan setting out, in detail, the steps it would need to take in order to wind down LCH in an orderly manner. This assessment includes a conservative estimate – six months – of the time and associated costs to achieve an orderly wind down. LCH holds an additional amount equal to six months operating expenses to meet potential wind down costs.

Key Consideration 3: An FMI should maintain a viable recovery or orderly wind-down plan and should hold sufficient liquid net assets funded by equity to implement this plan. At a minimum, an FMI should hold liquid net assets funded by equity equal to at least six months of current operating expenses. These assets are in addition to resources held to cover participant defaults or other risks covered under the financial resources principles. However, equity held under international risk-

based capital standards can be included where relevant and appropriate to avoid duplicate capital requirements. LCH maintains both a Recovery Plan and a Wind Down Plan, both of which are LCH Board-approved documents and which are reviewed at least annually, or following material changes. The Wind Down Plan sets out the steps it would be necessary to follow should LCH need to wind down its clearing services. This plan takes into account the impact on members and the markets of such a wind down. The plan demonstrates how LCH can achieve an orderly wind down within six months. The Recovery Plan sets out the steps that LCH should take in order to maintain the continuity of its services, should such continuity be threatened. This plan takes into consideration the triggers for such a plan, the governance steps LCH must take to invoke the plan and a number of recovery tools that are available to LCH. Each available tool is assessed for its impacts to LCH's clearing members. LCH holds capital equal to the operating expenses for the six month period required to wind down. LCH bases its calculation on the latest audited expenses. LCH invests its capital including the capital used to cover general business risks and the wind down plan in very high quality, very liquid instruments with low market risk. LCH capital is held on the balance sheet of LCH separately from the resources designated to cover clearing member defaults.	
Key Consideration 4: Assets held to cover general business risk should be of high quality and sufficiently liquid in order to allow the FMI to meet its current and projected operating expenses under a range of scenarios, including in adverse market conditions. LCH's assets held to cover business risk are composed of short term reverse repos, the purchase of short term highly liquid government securities and overnight cash deposits. The maturity profile of the reverse repos and cash held to cover general business risk means no conversion of assets is required. The securities are very high quality, very liquid and with low market risk. LCH assesses the quality and liquidity of its liquid net assets through daily monitoring, regular reporting and monthly internal governance reviews of the marked to market value of assets.	
Key Consideration 5: An FMI should maintain a viable plan for raising additional equity should its equity fall close to or below the amount needed. This plan should be approved by the board of directors and updated regularly. LCH has in place an LCH Board approved strategy setting guidelines for capital management and to act as a recovery planning step following a shock loss or other stress event. The strategy requires that material business decisions be assessed against capital position requirements, cash flow and liquidity and profitability, in order that LCH can generate capital via retained earnings. It also lays out other options that would be available to LCH and its Board in the event of a short term need for capital. As a wholly owned subsidiary of LCH Group Limited, the LCH strategy has been concluded in conjunction with the strategy of its parent. The LCH Board is given regular updates on the capital position of LCH through regular reporting from the Chief Financial Officer.	
Publicly available resources	Annual Report and Financial Statements Public quantitative disclosure standards for central counterparties

Principle 16: Custody and investment risks

An FMI should safeguard its own and its participants' assets and minimise the risk of loss on and delay in access to these assets. An FMI's investments should be in instruments with minimal credit, market and liquidity risks.
LCH's investment strategy is aligned to its overall risk management approach and regulatory obligations in the jurisdictions where it is permitted to operate. LCH maintains counterparty, custodian and (I)CSD relationships only after appropriate due diligence at the outset and satisfactory outcomes from ongoing review.
Key Consideration 1: An FMI should hold its own and its participants' assets at supervised and regulated entities that have robust accounting practices, safekeeping procedures, and internal controls that fully protect these assets.   LCH's internal risk policy on payment, settlement and custody sets a preference for safeguarding collateral (whether this is securities provided by members, held as investments, or as collateral received in reverse repos) in accounts at central securities depositories (including international central securities depositories). Where an (I)CSD is not able to be used (normally because of time zone or regulatory constraints), LCH uses a custodian bank or banks. In each case the entity holding the collateral must meet standards set in the policy, including criteria in relation to creditworthiness and operational reliability.   All (I)CSDs and custodian banks are subject to the requirements described in the internal risk policy on payment, settlement and custody, as well as the criteria set out in the internal risk policy on counterparty credit risk. These include a minimum internal credit score, legal review, operational due diligence and the application of exposure limits.   LCH's monitoring of compliance with its criteria, and the overall suitability of (I)CSDs and custodians, is via a regular programme of due diligence which reviews every entity at least every two years. This requires that (I)CSDs and custodians complete a template covering all matters referenced in the policy and provide evidence where necessary. (I)CSDs and custodians are also subject to periodic onsite due diligence reviews.
Key Consideration 2: An FMI should have prompt access to its assets and the assets provided by participants, when required.   LCH ensures it has prompt access to its assets by only maintaining custody arrangements with high quality (I)CSDs and custodians, as determined under its policy and through its due diligence programme, by maintaining multiple custody relationships and by taking legal advice.   In addition, (I)CSDs and custodians are asked to confirm the legal position in each due diligence exercise.
Key Consideration 3: An FMI should evaluate and understand its exposures to its custodian banks, taking into account the full scope of its relationships with each.   In relation to collateral, LCH satisfies itself via the due diligence process and legal review that it would have access to the assets in the event of the custodian bank's default. Where cash balances are held on account at a custodian bank temporarily in connection with investment activity, LCH manages transactions such that its intraday exposure to the custodian bank remains below 75 percent of its capital, a limit set in internal risk policy.   LCH uses a range of (I)CSDs and custodian banks to diversify where collateral is held. This includes two major (I)CSDs, the domestic UK Securities Settlement System an Australian CSD and two US custodians.   Risk exposures to custodian banks are aggregated with risk exposures to the same entities arising from investment, clearing or payments activity and monitored against credit limits set per entity.
Key Consideration 4: An FMI's investment strategy should be consistent with its overall risk-management strategy and fully disclosed to its participants, and investments should be secured by, or be claims on, high-quality obligors. These investments should allow for quick liquidation with

little, if any adverse price effect.

LCH's investment risk strategy is set by the LCH Board, on the advice of the Risk Committee, and in line with the LCH Board's Risk Appetite. The investment strategy is disclosed at an aggregate level on request to clearing members of LCH. How the total cash received from participants is held/deposited/invested is included in LCH's disclosures against the CPMI-IOSCO Quantitative Disclosure Standards. The primary objectives of the investment strategy are capital preservation and liquidity provision, and these objectives are captured in an LCH risk policy. The Policy's key stratagems are to restrict investments to (i) high quality counterparties, (ii) reverse repurchase arrangements against very high quality and liquid collateral using appropriate haircuts, (iii) the purchase of short term high quality, low credit risk and highly liquid securities, and (iv) keeping unsecured lending and deposits to a minimum. The Policy emphasises the preference for secured transactions and highly marketable securities and sets maturity limits based on investment types. Further, it also specifies liquidity risk as an objective and sets investment concentration limits and appropriate haircuts for reverse repurchase collateral. Additionally, the Policy requires that investment limits are reviewed regularly to ensure that they remain in line with risk appetite.

The concentration limits for LCH investment activities include restrictions on: exposures to particular counterparties, measured at the counterparty group level; the proportion of investments representing an exposure to a particular issuer; and exposures to reverse repo collateral, by security type and issuer. Additionally, LCH sets exposure limits specified at the investment counterparty level by transaction type (e.g. reverse repo, FX swap) and by maturity.

Intraday and overnight exposures are monitored against the applicable limits and any breaches are escalated, reported and remediated through internal governance processes.

LCH does not invest margin received from a clearing member in securities issued by that clearing member or its affiliates.

LCH maintains pre-arranged and highly reliable relationships with a wide range of high quality counterparties enabling execution of transactions with short-dated maturity. LCH also tests the ability to liquidate such financial assets with little, if any adverse price effect with these counterparties according to a regular programme.

Publicly available resources	Risk Management Overview Custodian Settlement Details Custodian Settlement Details - FCM Public quantitative disclosure standards for central counterparties

Principle 17: Operational risk

An FMI should identify the plausible sources of operational risk, both internal and external, and mitigate their impact through the use of appropriate systems, policies, procedures, and controls. Systems should be designed to ensure a high degree of security and operational reliability and should have adequate, scalable capacity. Business continuity management should aim for timely recovery of operations and fulfilment of the FMI's obligations, including in the event of a wide-scale or major disruption.

Operational risk management is a key component of the LCH risk management framework and encompasses appropriate tools and mechanisms to enable the effective identification, assessment and mitigation of such risk. The operational risk management arrangements incorporate a "three lines of defence" structure that has been endorsed by the LCH Board, and places responsibility for managing operational risk on the business as the first line of defence, ensuring that an Accountable Executive from the business is appointed as Risk/Control Owner.

Key Consideration 1: An FMI should establish a robust operational risk-management framework with appropriate systems, policies, procedures, and controls to identify, monitor, and manage operational risks.

LCH has in place policies and procedures that form the framework through which operational risk is managed throughout LCH at an enterprise level.

These documents clearly set responsibilities across first, second and third lines of defence for the identification, assessment, monitoring and management of operational risks.

They also set a framework through which operational risks can be identified, including through review of audit findings, loss events and near misses, external events which may give rise to increased vulnerabilities and changes to systems or processes. The policy also includes requirements to complete scenario analysis, stressing these operational risks through workshop-based exercises. Such exercises and oversight ensure operational procedures are implemented appropriately.

Each operational risk is recorded in an operational risk management system. The system also includes records of risk assessments, controls in place and any actions being taken to further reduce the risk exposure associated with any operational risks. Operational risks are monitored through regular review and reporting to ERCO, senior executive management committees and the Audit Committee.

LCH has a Recruitment Policy and framework which sets rigorous pre-employment screening for all prospective LCH employees. Once in role, LCH employees are subject to, at least annual, performance reviews. The company also has policies in place which encourage employees to attain qualifications and professional standards linked to their role. Aside from these benefits, and appropriate remuneration, the company has identified tools to endeavour to retain key staff should turnover be identified as a risk.

LCH has both operational risk and compliance policies in place designed to identify potential sources of fraud, which set the standards within which potential fraud should be managed. These policies and procedures identify potential sources of fraud, key mitigation techniques and the procedures to follow should a fraud or potential fraud be reported. The Recruitment Policy and procedures require that all prospective LCH employees, including agency staff and consultants, are subject to pre-screening checks before their employment can begin.

LCH has a governance framework for change management. This framework mitigates the risks that changes and major projects inadvertently affect the smooth functioning of LCH by setting out a flexible (by size and complexity of change) structure for delivery of change. The framework sets out a methodology of categorising change; the category of change then determines the appropriate governance, reporting, minimum testing requirements and finally go-live approvals. Each LCH business line maintains oversight of its change portfolio.

Key Consideration 2: An FMI's board of directors should clearly define the roles and responsibilities

for addressing operational risk and should endorse the FMI's operational risk-management framework. Systems, operational policies, procedures, and controls should be reviewed, audited, and tested periodically and after significant changes.

Operational risk forms part of the Risk Governance Framework of LCH, and is one of 22 types of risk which LCH faces. The LCH Board has set out through this framework its appetite for operational risk.

The Operational Risk policy, which is approved by the LCH Board, clearly defines the key roles and responsibilities for operational risk. These responsibilities are separated between the first, second and third lines of defence; in general the first line of defence is responsible for the day to day management operational risks, including maintaining an effective system of internal controls. The first line is within the business lines and support functions. The second line oversight, support and challenge is provided by a dedicated operational risk management function. This function is also responsible for providing aggregated reporting to internal senior executive committees as well as the LCH Board and its Committees. LCH's independent internal audit function provides the third line of defence by delivering a programme of assurance.

The Operational Risk Policy is reviewed annually and the results of the review are reviewed by senior internal executive level committees as well as Board-level committees. The LCH Board approves the policy annually. The Audit Committee receives quarterly reporting on any operational risks outside appetite, including actions planned or taken to mitigate these risks, and major incidents, including remediation planned or taken to prevent reoccurrence.

LCH reviews and tests its systems, policies and procedures with its clearing members in a number of ways. LCH involves its clearing members in testing before the launch of new products and systems. An annual business continuity test is carried out, in which all clearing members, external providers and other third parties (as identified in Business Impact Assessments (BIAs)) are invited to participate. Clearing members are also active in annual default management fire drills, in which the management of a default scenario is rehearsed. In each of these cases, LCH actively requests feedback in order that any weaknesses may be addressed.

LCH's independent audit function conducts regular reviews of the Operational Risk Framework. The internal audit function also reviews the application of the operational risk framework as part of all its reviews, with an annual review of a sample of key controls.

Key Consideration 3: An FMI should have clearly defined operational reliability objectives and should have policies in place that are designed to achieve those objectives.

LCH has an objective to be the most trusted clearing house and recognises to achieve this it must have resilience and efficiency. The Board sets a Risk Appetite and endorses a Risk Management Framework to manage reliance, reliability and stability of the CCP, which is cascaded throughout the firm.

LCH defines the escalation category of any incident. All incidents with a 'High' or above materiality rating are escalated to the executive management team. These incidents are investigated fully with a root causes analysis conducted, and steps identified to prevent reoccurrence.

As part of LCH's development and quality assurance processes, quality gates have been introduced to create an additional layer of testing and acceptance which has also proven to reduce the number of incidents following significant releases.

Key Consideration 4: An FMI should ensure that it has scalable capacity adequate to handle increasing stress volumes and to achieve its service-level objectives.

Each LCH clearing service is the subject of monthly service reviews. The reviews assess capacity statistics as part of its consideration of key performance indicators. Each clearing service is rated, based on average daily volumes and peak volumes versus the capacity to which it has been tested and database utilisation. Trends in trade volumes and 12 month projections are also reviewed. Furthermore, ahead of the implementation of new products or system changes, LCH performs testing to provide assurance that system capacity will be, or will remain, adequate for normal and stressed volumes.

LCH systems are subject to regular risk based independent review by the internal audit function; critical systems will be reviewed at least annually.

Should real-time system monitoring and monthly service reviews reveal capacity performance and trends which have or may disrupt operational functioning, action will be taken to investigate the cause and identify necessary timelines for increasing headroom for capacity. If capacity were to be exceeded, this would be investigated and remediated as any other incident in the clearing services. Following remediation LCH will investigate the root cause and implement steps to prevent reoccurrence.

Key Consideration 5: An FMI should have comprehensive physical and information security policies that address all potential vulnerabilities and threats.

LCH has a number of policies, procedures and controls in place for safeguarding its physical and information security. Regular reviews are undertaken to understand potential vulnerability and threats i.e. physical, intrusion and natural disaster, that LCH may be subject to.

Key Consideration 6: An FMI should have a business continuity plan that addresses events posing a significant risk of disrupting operations, including events that could cause a wide-scale or major disruption. The plan should incorporate the use of a secondary site and should be designed to ensure that critical information technology (IT) systems can resume operations within two hours following disruptive events. The plan should be designed to enable the FMI to complete settlement by the end of the day of the disruption, even in case of extreme circumstances. The FMI should regularly test these arrangements.

The LCH Business Continuity Management (BCM) programme has been developed to provide continuity and timely recovery of its business operations in the event of a major incident or crisis, which impacts, or has potential to impact, business operations. The Business Continuity policy sets a recovery time objective (RTO) of two hours for all critical services; this RTO is in place regardless of the scale of the incident or disruption. A Disaster Recovery Plan is also in place which describes the technical steps that are required in order to affect a timely recovery. Critical operations have been identified through BIA at a clearing service and function level. BIAs also identify which systems, resources and staff will be required to carry on the orderly functioning of LCH in the event of a disaster. Each clearing service and function has also created a Business Continuity Plan which enables it to meet the LCH RTO. Each clearing service and function includes in its Business Continuity Plan, where relevant, details of actions which include liaison with trade sources and data reconciliations, designed to ensure all transactions can be identified, and any data loss remediated. A Crisis Management Team (CMT), including representatives of all clearing services and functions, will be convened in the event of a crisis. The CMT will work to a predefined Crisis Management Plan, which ensures that the response to and management of a crisis is co-ordinated and effective, minimising the impact on clearing members, suppliers, employees and the reputation of LCH. LCH has immediate access to work area recovery facilities with a third party supplier. In the event of the loss of the primary office location in London, activities are transferred to a secondary business location, with overflow facilities at a third facility where required. Staff in critical roles also have access to remote working facilities which are tested regularly.

LCH has three data centres. These facilities are regularly tested; specifically the Business Continuity Programme requires at least an annual test of failover.

Key Consideration 7: An FMI should identify, monitor, and manage the risks that key participants, other FMIs, and service and utility providers might pose to its operations. In addition, an FMI should identify, monitor, and manage the risks its operations might pose to other FMIs.

LCH has identified operational, financial, credit, market and legal risks that can arise from its clearing members, other FMIs and service and utility providers.

The operational risks of such connections with regards to business continuity are identified and analysed as

part of each clearing service and function's BIAs. Identification and management of credit risks in relation to LCH's clearing members is included in *Principle 4*. Identification and management of risks related to links to other FMIs is included in *Principle 20*. Risks related to service and utility providers are addressed through an LCH Policy. This policy requires that supplier selection is transparent, that due diligence is performed on suppliers, that an appropriate contract is in place for the services and that suppliers agree to a Supplier Code of Conduct. Any extension of current activity with an existing supplier must also comply with this policy. Any supplier which is critical, as identified through the BIA process, undergoes a higher level of due diligence. This allows LCH to identify any potential additional risks arising from the supplier and to mitigate where possible. Outsourced service providers are required to have in place business continuity arrangements equivalent to those in place at LCH. Outsourced providers of services required for the successful recovery of LCH in the event of a crisis are required to be involved in business continuity testing. Besides considering the risks posed to LCH by FMIs, LCH considers the risks it may pose to other FMIs. Consequently, in addition to conducting its own ongoing due diligence, LCH cooperates and participates in reciprocal due diligence, for example service review meetings and Business Continuity testing which include external parties. Service providers, exchanges and linked FMIs are invited to participate in the annual failover test.	
Publicly available resources	Business Continuity Public quantitative disclosure standards for central counterparties

Principle 18: Access and participation requirements

An FMI should have objective, risk-based, and publicly disclosed criteria for participation, which permit fair and open access.

LCH's participation requirements are designed to be the least restrictive while ensuring that risk to LCH and the markets its serves is minimised. Participation criteria are publicly available through the LCH Rulebook and website, and clearing members are monitored for ongoing compliance with the requirements. The LCH Rulebook contains provisions to manage circumstances where a clearing member no longer meets the criteria.

Key Consideration 1: An FMI should allow for fair and open access to its services, including by direct and, where relevant, indirect participants and other FMIs, based on reasonable risk-related participation requirements.

Requirements for participation in LCH are based on risk-based principles, and are designed to ensure that all clearing members are of suitable financial standing with sufficient operational capabilities. Final approval for all participation applications rests with the Executive Risk Committee, subject to the LCH Risk Committee being notified of approvals. Where the Executive Risk Committee refuses an application, the applicant may appeal to the Risk Committee. All new members are also subject to an internal LCH credit assessment.

Minimum levels of net capital and default fund contributions are required as part of the clearing member admission criteria. These are set out below by service.

Service	Clearing member type	Minimum Net Capital Requirement	Default Fund	Minimum Default Fund Contribution[11]
CommodityClear	CommodityClear clearing member	£1m	Commodities	$0.75m
EquityClear	Individual clearing member	£5m	Equities	£0.5m
EquityClear	General clearing member	£10m	Equities	£0.5m
LSE Derivatives Market	Individual clearing member	£1m	Equities	£0.5m
LSE Derivatives Market	General clearing member	£2m	Equities	£0.5m
Listed Rates	Individual clearing member	£1m	Rates Derivatives	£0.5m
Listed Rates	General clearing member	£2m	Rates Derivatives	£0.5m
RepoClear	Individual clearing member	€100m	RepoClear	£2.5m or its equivalent in €
RepoClear	General clearing member	€400m	RepoClear	£2.5m or its equivalent in €
SwapClear	SwapClear clearing member	$50m	Rates Derivatives	£10m (plus £3m in respect of the additional trade registration component).
SwapClear	Futures Commission	$50m	Rates Derivatives	£10m (plus £3m in respect of the

[11] These are published at http://www.lchclearnet.com/members-clients/members

	Merchant			additional trade registration component).
ForexClear	ForexClear clearing member	$50m	ForexClear	US$5m
ForexClear	Futures Commission Merchant	$50m	ForexClear	US$5m

In terms of operational capability, all clearing members must have adequate back office infrastructure to support a high volume of transactions, and must open accounts with eligible PPS banks, to pay and receive cash obligations to and from LCH. Typically, this requires appropriate systems to manage the clearing member's clearing activities, and staff with sufficient knowledge and experience with the systems. Prior to going live, all clearing members receive operational capability training if the LCH onboarding function deems it necessary.

For its SwapClear and ForexClear services, LCH conducts default fire drills twice a year; a failure to participate or perform in a drill may lead to suspension. Clearing members can, in lieu of participation in a fire drill, demonstrate that they have an affiliated clearing member or an 'Approved Outsourcing Agent'[12] that has taken part on the clearing member's behalf. These tests have been designed to demonstrate the clearing member's ability to load, price and bid on a fixed number of trade sides in auctions held to manage a clearing member default. For RepoClear, members are obliged to make best efforts to bid if asked to do so. At fire drills selected members are asked to bid on auction packs. The EquityClear and Listed Rates services clear commoditised products which have mature electronic price discovery and price-discovery regulation. In these cases LCH has arrangements with execution brokers to close positions rather than undertaking auctions. For CommodityClear, LCH has arrangements with execution brokers to close out positions in the market. Where possible, an auction may be organised, but current clearing members have no obligation to participate. EquityClear, Listed Rates[13] and CommodityClear hold fire drills at least annually.

All applicants for SwapClear and ForexClear membership must provide an opinion which must be provided by an independent external legal adviser practising in the relevant jurisdiction confirming that it has all necessary permissions and capacity to undertake its obligations as a clearing member in accordance with its and LCH's regulatory obligations.

LCH may impose additional risk-based conditions on clearing members and may at any time vary or withdraw any such conditions. These conditions may include a requirement to post additional collateral or a requirement for prior authorisation for trades above a defined ceiling.

To achieve a balance between open access and risk, LCH continuously monitors a wide range of credit indicators for members, including capital-to-risk ratios, and applies real-time risk management controls such as concentration limits and margin multipliers, rather than relying solely on hurdle-based participation criteria. In addition, the default management process seeks to ensure that a member's contingent obligations in the event of default are commensurate with the nature and scale of its cleared activity.

Key Consideration 2: An FMI's participation requirements should be justified in terms of the safety and efficiency of the FMI and the markets it serves, be tailored to and commensurate with the FMI's specific risks, and be publicly disclosed. Subject to maintaining acceptable risk control standards, an FMI should endeavour to set requirements that have the least-restrictive impact on access that circumstances permit.

LCH's participation requirements are designed to mitigate the risks that LCH faces as a CCP in a way that ensures the least restrictive access that circumstances permit.

Net capital requirements ensure that clearing members have adequate financial resources to withstand

[12] An Approved Outsourcing Agent can only sponsor a maximum of three members. As of 31 March 2017 no SwapClear or ForexClear member use these Agents)

[13] Listed Rates is tested with the SwapClear service during firedrills for the Rates Derivatives default management process.

unexpected losses.

Default fund contributions for each relevant service are determined with reference to a clearing member's initial margin requirements, which are in turn determined with reference to the nature and scale of a clearing member's cleared activity. The floor for default fund contributions seeks to ensure that all clearing members have enough capital at risk such that they have an appropriate incentive to monitor and control the risks that they bring to the service. See also *Principle 4*.

Membership requirements are risk-based, including the need to have all necessary operational capabilities e.g. access to relevant trading and settlement venues, and to have necessary regulatory permissions.

Different criteria apply depending on the nature of membership being applied for. Broadly, criteria may be differentiated by the service being applied to clear, and whether the applicant would be clearing only for itself or additionally for clients. The differing nature of risk being brought by the applicant is determined by these elements, and criteria are set in a manner proportionate to the risk.

The participation criteria, including restrictions in participation are publicly disclosed on the LCH website and are included in the LCH Rulebook.

Key Consideration 3: An FMI should monitor compliance with its participation requirements on an ongoing basis and have clearly defined and publicly disclosed procedures for facilitating the suspension and orderly exit of a participant that breaches, or no longer meets, the participation requirements.

LCH monitors compliance with participation requirements on a continuous basis. The clearing membership Agreement requires clearing members to notify LCH if they no longer meet the participation requirements.

The LCH Rulebook contains notification and disclosure requirements to ensure compliance with the financial requirements for participation in each service. All clearing members must provide LCH with their annual accounts, and must promptly notify LCH of any development which would materially affect the clearing member's ability to comply with the participation requirements. Fire drills (see under Key Consideration 1) assess whether clearing members' operational capabilities continue to meet LCH's minimum standards.

Regulated clearing members must provide LCH with copies of all returns made to their regulators, and these are required within 30 days of their original submission. Non-regulated members must provide quarterly balance sheet and profit and loss statements within 30 days of their quarter end. LCH monitors all members daily with reference to public information including credit ratings, share prices, credit spreads and media comment.

The Rulebook outlines the actions that LCH can take if there is an indication that a member no longer meets the membership requirements or if its risk profile deteriorates, including: more detailed monitoring, increased margin requirements, prior authorisation for trades above a specified size, position reduction, position transfer to other members, trading for liquidation only, and the declaration of default. LCH has the authority to declare a member in default as soon as it has grounds to suspect the membership requirements are breached or are likely to be breached. Where a clearing member is in breach of the membership requirements, but has not defaulted on payments to LCH, LCH may allow a grace period for the clearing member to remedy the breach before issuing a Default Notice. Once a default notice has been issued, withdrawal of the member occurs in accordance with the Default Procedures.

In the case of a voluntary withdrawal by a clearing member, at least three months' notice is required. The clearing member must terminate all open contracts registered with LCH within this 90 day period. If after 90 days the portfolio has not been closed out, LCH may liquidate the portfolio or require the clearing member to remain in the service until there are no remaining contracts. PPS arrangements must be maintained until all fees have been collected and to enable repayment of the member's default fund contribution(s).

LCH has procedures in place to facilitate the suspension and orderly exit of members; these are disclosed in the Rulebook publicly available on the LCH website.

Publicly available resources	Rulebook Clearing Members Training Public quantitative disclosure standards for central counterparties

Principle 19: Tiered participation arrangements

An FMI should identify, monitor, and manage the material risks to the FMI arising from tiered participation arrangements.

Clearing members act as principals to LCH for both proprietary and client business, including under the FCM model. This means that there is no direct exposure to the default of a clearing member's client; however, the LCH Rulebook provides for LCH to collect information from clearing members about their clients or indirect clients. Where a portfolio is overly concentrated LCH may apply margin multipliers to mitigate such risk. LCH also takes steps to mitigate risk from tiered participation by offering porting to all clients.

Key Consideration 1: 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 participation arrangements.

LCH primarily uses a principal-to-principal model of clearing participation, which means that LCH has no direct exposure to the default of a clearing member's client. Obligations to LCH arising from the activities of indirect participants are in all cases principal obligations of the relevant clearing member, and the risk management processes referred to under Principles 3-10 apply to risk arising from positions recorded in clearing members' proprietary and client accounts.

Before offering client clearing, a clearing member must obtain authorisation from the LCH Onboarding Department.

LCH requires clearing members who clear for clients, affiliates or other third parties to hold segregated house and client accounts for positions and collateral. Therefore, LCH offers a choice of Individually Segregated Accounts (ISA) and Omnibus Segregated Accounts (OSA) to its members. This model supports clearing of direct clients (client of clearing member) as well as indirect clients (client of client of clearing member).

For the SwapClear, Listed Rates and ForexClear Services, LCH also offers a FCM model that is compliant with CFTC requirements for clearing members that have US-based clients.

A more detailed discussion on LCH's segregation and portability arrangements can be found at *Principle 14*.

LCH collects varying degrees of information about clients of clearing members, depending on the segregation model selected through client account opening procedures. This information is provided and updated by clearing members as LCH has no contractual arrangements with clearing members' clients. LCH continuously reminds its clearing members to keep client information up to date and to provide updates at the very least annually.

The data collected is most detailed in the case of clients selecting ISAs, or clearing under the US FCM regime. For other models, LCH may not have detailed client information. For example, clearing members may also provide client information for those clients which use OSAs. This is not mandatory and the information should be maintained by the clearing members.

Indirect client ("client-of-client") accounts are visible to LCH in the same way as direct client accounts and hence are subject to the same level of scrutiny and monitoring as direct client accounts. Therefore indirect client clearing risks are identified in each account similarly to direct client clearing risks. Margin models have been developed and implemented to measure these risks on an overnight and intraday basis. However, LCH does not hold details of individual clients of clients.

The material risk arising at LCH from tiered participation is the default of a client, which disrupts or materially adversely affects a clearing member. In the event of a clearing member default, LCH could face risks should positions and collateral held for clients of a defaulting clearing member not be able to be ported. LCH may therefore, in these circumstances. liquidate client positions and apply collateral in the same way as for proprietary accounts. Following the completion of default-management processes (the closing or transfer of positions and the realisation of collateral) LCH may apply surpluses in a clearing member's house account(s) to offset losses in the clearing member's client account(s), but not vice versa.

LCH mitigates these risks through setting appropriate membership criteria for its clearing members, by monitoring client portfolios and accounts, and by setting rules which allow the efficient and timely porting of clients in default scenarios.

Key Consideration 2: An FMI should identify material dependencies between direct and indirect participants that might affect the FMI.

LCH monitors the activity of its clearing members and the activity in each of its client accounts, be they in omnibus or individual accounts. LCH monitors the proportion of house to client activity for its clearing members, and where clients are known, LCH is able to establish an account of the activity with named clients in total, by clearing service.

LCH can apply margin multipliers where a clearing member's aggregate client portfolio is overly concentrated. The LCH margin methodology (in terms of initial, liquidity and concentration margin) increases margin requirements progressively with large positions in both proprietary and client accounts.

Key Consideration 3: An FMI should identify indirect participants responsible for a significant proportion of transactions processed by the FMI and indirect participants whose transaction volumes or values are large relative to the capacity of the direct participants through which they access the FMI in order to manage the risks arising from these transactions.

As outlined above, LCH monitors the activity of its clearing members and the activity in each of its client accounts, be they in omnibus or individual accounts. LCH monitors the proportion of house to client activity for its clearing members, and where clients and indirect clients are known by LCH is able to build a picture of the exposure to named clients in total, by clearing service and by client.

Activity, whatever its source, in all clearing services is monitored on a daily basis.

LCH produces daily reports which are used to monitor client positions and associated cash flows. LCH has the ability to apply margin multipliers, where a clearing member's client portfolio is overly concentrated.

Key Consideration 4: An FMI should regularly review risks arising from tiered participation arrangements and should take mitigating action when appropriate.

LCH requires its clearing members wishing to offer indirect participation in new jurisdictions to provide a legal opinion outlining amongst other things that no impediment will be introduced to the course of the usual LCH activities, including default management, by such indirect participation. On receiving each opinion LCH will review whether any additional risks must be mitigated within its Rulebook.

Risk management policies and procedures covering indirect participation are reviewed at least annually.

LCH produces daily reports to monitor client positions and associated cash flows. LCH can apply margin multipliers, where a clearing member's client portfolio is overly concentrated.

LCH reviews the risks it accepts within the LCH Board's appetite for risk.

Publicly available resources	Rulebook Legal Opinions Public quantitative disclosure standards for central counterparties

Principle 20: FMI links

An FMI that establishes a link with one or more FMIs should identify, monitor and manage link-related risks.

LCH has multiple and varied FMI links: specifically LCH maintains links with (I)CSDs, Trade Repositories, Exchanges, Payment Systems and other CCPs. All such arrangements are considered within the LCH risk management framework and subject to rigorous detailed due diligence and rigorous internal governance processes.

Key Consideration 1: Before entering into a link arrangement and on an ongoing basis once the link is established, an FMI should identify, monitor, and manage all potential sources of risk arising from the link arrangement. Link arrangements should be designed such that each FMI is able to observe the other principles in this report.

LCH maintains FMI links with (I)CSDs, CCPs, Trade Repositories and Payment Systems. Such link arrangements are governed by contractual agreements.

Connecting to a new FMI is subject to LCH internal policies and procedures which set out requirements and the governance approval process to be followed. LCH policies identify the criteria to be met, set out certain risks posed, and assigns responsibility for monitoring, analysis and escalation of such risks. LCH will assess a new FMI through onsite due diligence and review of documentation and information acquired both directly and indirectly. The review will include assessment against criteria such as corporate structure, credit risk, operational and technical resilience, legal structure and associated risk, operational risk and contingency arrangements. Findings with a final recommendation will be presented through the LCH internal risk governance process for approval.

Ongoing due diligence of FMI links that are intermediaries such as (I)CSDs, and others that give rise to settlement, payment or custody risks is performed at least every two years, or may be sooner if there have been significant changes. This type of FMI will be assessed against criteria and risks set out in a Group Policy and will consider applicable conditions of Principles 8, 11 and 17.

The key risks brought about by links to Trade Repositories are regulatory and reputational, and Trade Repositories will be assessed against such risks in accordance with the Group Procurement Policy, at least every two years or sooner if there have been significant changes.

For inter-operating CCPs the review frequency and the factors for consideration are set out in a Group Policy which notes that the factors, metrics and adjustments for Interoperating-CCPs, are subject to review on at least an annual basis and independently validated in accordance with the Model Validation policy. Additionally, inter-operating CCP arrangements are subject to internal governance processes and regulatory review and non-objection.

LCH's recovery planning process also reviews the impact to itself and its FMI links in the event either party enters into a recovery scenario. At a minimum, FMI link due diligence considers the impact from operational failures, liquidity issues and overall creditworthiness, and any risk mitigants such as contingency processes. The results of ongoing due diligence are presented for review through the LCH internal risk governance process.

Finally, LCH's Rulebook Settlement Finality Regulations are intended to mitigate the risks associated with payments and securities settlement. These Regulations are supported by LCH's designation under the UK Financial Markets and Insolvency (Settlement Finality) Regulations 1999 (see Principle 8 for further information).

Any new FMI link is established and maintained in accordance with LCH internal risk policies which are aligned to the PFMIs. The policies are subject to annual review, and each FMI link arrangement is subject to ongoing monitoring and periodic review.

Key Consideration 2: A link should have a well-founded legal basis, in all relevant jurisdictions, that

supports its design and provides adequate protection to the FMIs involved in the link.

As set out above, LCH conducts detailed due diligence prior to establishing a new FMI link. At the time of writing LCH maintains links with FMIs in the UK, USA, Australia, Belgium, Denmark, Finland, Italy, Luxembourg, Norway, Spain, Sweden, and Switzerland. LCH's arrangements with FMI links are governed by contractual agreements, which specify the law governing such an agreement. A component of LCH's due diligence is review and assessment of the applicable legal framework in the jurisdiction where such FMI is located, and review and assessment of the FMI's terms and conditions where LCH agreement and adherence is required. For inter-operating arrangements with a FMI that is a CCP, the legal framework governing such agreements adheres to the ESMA Guidelines on Interoperability, and to establish enforceability LCH obtains appropriate legal opinions such as in respect of insolvency, inter-CCP pledge agreements, treatment of collateral, LCH's netting rules and applicable sections of the LCH Rulebook.

Key Considerations 3-6 are not applicable to CCPs.

Key Consideration 7: Before entering into a link with another CCP, a CCP should identify and manage the potential spill-over effects from the default of the linked CCP. If a link has three or more CCPs, each CCP should identify, assess, and manage the risks of the collective link arrangement.

All of LCH's interoperable-CCP links are governed and managed on a bilateral basis.

LCH will only consider entering into a CCP inter-operable arrangement where the other CCP is recognised by its home regulators as a central counterparty and that CCP adheres to CPMI-IOSCO principles via the local regulatory regime.

The terms of reference of the LCH Risk Committee mandates that interoperable-CCP links must be reviewed and approved prior to acceptance, and all interoperable arrangements must meet established LCH risk standards which are set out in various internal risk policies. In assessing the spill-over risk from the default of a linked CCP, consideration is given to the presence of default waterfall and default management procedures within the interoperating CCP's rules and procedures, and that risk is fully collateralised through exchange of margin. In addition to contagion risk, LCH also assesses the market and credit risk posed by the inter-operating CCP, and ensures additional margin is called where necessary. For its ongoing review LCH conducts quarterly meetings with the inter-operating CCP's Risk Manager to obtain information on any material changes such as changes to the inter-operating CCP's margin methodologies, operational risk framework or third party relationships.

Key Consideration 8: Each CCP in a CCP link arrangement should be able to cover, at least on a daily basis, its current and potential future exposures to the linked CCP and its participants, if any, fully with a high degree of confidence without reducing the CCP's ability to fulfil its obligations to its own participants at any time.

The LCH risk framework takes into account exposures to interoperating CCPs. In accordance with a Group Policy, Inter-operable CCP arrangements are subject to threshold and other monitoring on an ongoing basis. Changes to certain data and threshold breaches are escalated for action, such as additional margin being called. The Policy sets out guideline escalation triggers thus ensuring that current and potential future exposures are covered with a high degree of confidence. Moreover, stress testing procedures ensure LCH's margin models maintain at least a 99.7 percent confidence level, and margin posted to cover inter-CCP risk is held in a bankruptcy remote structure.

In accordance with the ESMA Guidelines on Interoperability, LCH does not require an interoperating CCP to contribute to any LCH default fund, and nor does LCH contribute to the default fund of any interoperable CCP. LCH's default fund for the particular clearing service in which the interoperating CCP participates is sized to include the interoperating CCP's positions. Hence any additional contribution arising from an interoperating CCP is provided pro rata by the Clearing Members of that clearing service. Moreover, LCH has a number of processes in place to manage inter-CCP risk, for example regular intraday Initial Margin

and Variation Margin calls, End of Day Margin calls and regular stress testing of inter-CCP exposures. Further, the rights and obligations set out in the legal documents govern the process by which each CCP ensures that risk is managed. LCH has the right and ability to call additional margins, including concentration, liquidity and stress margins where an assessment has been made that additional resources are required to mitigate potential losses and ensure LCH's ability to fulfil its obligations to its Clearing Members is not affected at any time. LCH consults with its Clearing Members of the respective clearing service, where there is material change to any interoperable CCP arrangement, and publically discloses on its website any interoperable CCP arrangements, and the general risks of participating in such a service in relation to sharing of uncovered losses and uncovered liquidity shortfalls resulting from a CCP link arrangement, and as set out in the LCH Rulebook Default Rules.	
Key Consideration 9 is not applicable to CCPs.	
Publicly available resources	Interoperability Disclosure Public quantitative disclosure standards for central counterparties

Principle 21: Efficiency and effectiveness

An FMI should be efficient and effective in meeting the requirements of its participants and the markets it serves.

LCH maintains an operating structure that considers its clearing members, the products cleared and is designed to be efficient and effective. The mechanisms within this operating structure are subject to periodic review to ensure that they remain productive and continue to facilitate the goals and objectives of participants and the markets LCH serves.

Key Consideration 1: An FMI should be designed to meet the needs of its participants and the markets it serves, in particular, with regard to choice of a clearing and settlement arrangement; operating structure; scope of products cleared, settled, or recorded; and use of technology and procedures.

LCH is a global multi-asset class clearing house, serving a broad number of major exchanges and platforms as well as a range of OTC markets. LCH's commitment to the horizontal model ensures a clear growth path for clearing across multiple markets, exchanges, venues and geographies.

LCH is committed to working closely with its members and the markets it serves to provide clearing solutions and adheres to a publicly available code of conduct which sets out the minimum standards for engagement with stakeholders.

LCH is partly owned by its members and as a consequence the members are part of the governance process and are represented on relevant committees. The LCH Board and the Risk Committee include user and independent representation. LCH also has a number of advisory and risk working groups, which relate to specific products or projects and through these forums and member consultation ensures consideration of clearing member needs in terms of products and technology. Any change which may fundamentally affect the way LCH operates will involve a change to the LCH Rulebook. Changes to the Rulebook are considered by the Rule Change Committee, which includes representatives of the compliance and legal functions and a clearing business representative. This Committee will independently assess changes and set a minimum time for member consultation. Feedback received from clearing members is assessed and any further changes made will be considered by the Rule Change Committee before it can be made live. Further, LCH is an active market participant, providing thought leadership into industry-wide initiatives to promote financial stability and to improve the effectiveness and efficiency of the markets.Any significant changes that fundamentally affect the way that LCH operates are made after member consultation. Additionally members are involved in the development and testing of new releases of technology relating to new products or systems.

The LCH client management functions collect and collate enhancement and change requests from members and provides to senior management for consideration.

Key Consideration 2: An FMI should have clearly defined goals and objectives that are measurable and achievable, such as in the areas of minimum service levels, risk- management expectations, and business priorities.

LCH’s principal objectives are:

- To provide market leading risk management and clearing solutions.
- To manage our members’ and clients’ risk by providing effective and efficient clearing services.
- To promote a safe and stable financial market foremost in all that we do.

The strategy for achieving these objectives is:

- To maintain a sound risk management approach and resilient systems
- To set and maintain the highest standards across all asset classes cleared, in line with evolving regulatory requirements

• To work closely with market participants to develop and deliver new services and products that increase clearing efficiencies globally The LCH Board supports the highest standards in corporate governance and through its internal governance process creates and maintains well defined strategic and financial plans. Progress against goals and objectives are included in the publicly available consolidated LCH Group report and accounts. LCH maintains dialogue with its clearing members through product specific user working groups and regularly consults its clearing members to obtain feedback. LCH senior management reporting enables the LCH Board to assess and have oversight of the progress of LCH against its goals and objectives, including the strategy and the priorities for its senior executive. LCH management assesses performance against its annual Corporate Strategic Objectives on a quarterly basis. Performance against these objectives is reported to the LCH Group Board and the LCH Remuneration Committee. In addition LCH management regularly reviews its Risk Governance Framework, and reports to the Board on the extent to which risks are managed within the LCH Board's tolerance for these risks. LCH's financial performance against budgets, targets and multi-year financial plans is also regularly reviewed and progress reported to the Board.	
Key Consideration 3: An FMI should have established mechanisms for the regular review of its efficiency and effectiveness. LCH has carried out a number of reviews of its operating model with a view to improving efficiency and effectiveness. LCH has implemented a range of initiatives including outsourcing of shared corporate and technology services under separate legal contracts with LSEG, its majority shareholder. This has resulted in a number of employees transferring from LCH Group to LSEG functions with direct cost reduction achieved and reduced headcount. In early 2017, LCH also transferred some technology support functions to a new LSEG captive provider which will deliver reduced costs vs LCH's existing supplier with no reduction in service or increase in risk. LCH has also created a Group Procurement function with LSEG and achieved a reduction in third party spend through the buying power of the enlarged group. This has been a continuing effort since 2014 and initiatives continue today. LCH continues to review its operating models to ensure they are fit for purpose to support LCH's business whilst being lean and efficient. This includes organisation design reviews of all operating units..	
Publicly available resources	Code of Conduct Markets Served LCH Objectives LCH Committee Terms of Reference

Principle 22: Communication procedures and standards

An FMI should use, or at a minimum accommodate, relevant internationally accepted communication procedures and standards in order to facilitate efficient payment, clearing, settlement, and recording.
LCH uses internationally accepted communication procedures and standards where they are existing and practicable. Where such standards and procedures are not defined, LCH may facilitate use of proprietary messaging.
Key Consideration 1: An FMI should use, or at a minimum accommodate, internationally accepted communication procedures and standards.   LCH works to internationally-recognised procedures and standards wherever possible.   For payments, LCH uses SWIFT ISO15022 standards for all payment instructions. For securities settlement, LCH uses a combination of SWIFT ISO 15022 standards and the CSD/Custodian's proprietary GUI interfaces.   Clearing members may provide settlement instructions to LCH either through LCH's proprietary GUI interface (CMS) or via SWIFT ISO 20022 standard Collateral Proposal message. LCH sit on the ISO 20022 Securities Evaluation Group and contributes to defining international standards.   As well as providing proprietary reporting to clearing members, LCH provides wherever possible standards based reporting. This is the case for cash and securities reconciliation messages and more recently margin calls messaging. These messages can be provided directly to clearing members or to nominated third parties i.e. collateral managers or custodians.   Where industry standard interfaces for custodians and (I)CSDs are not available LCH either develops to third party specifications or defines a proprietary interface.

Publicly available resources	PPS Arrangements Member Connectivity Guide

Principle 23: Disclosure of rules, key procedures, and market data

An FMI should have clear and comprehensive rules and procedures and should provide sufficient information to enable participants to have an accurate understanding of the risks, fees, and other material costs they incur by participating in the FMI. All relevant rules and key procedures should be publicly disclosed.

The LCH website discloses the publicly available LCH Rulebook, the fees and risks associated with becoming a clearing member of LCH, as well as details of the LCH default waterfalls. Details of accepted eligible collateral including haircuts, and clearing member participation criteria are also disclosed on the publicly available LCH website, as is volume and value transaction data for each service.

Key Consideration 1: An FMI should adopt clear and comprehensive rules and procedures that are fully disclosed to participants. Relevant rules and key procedures should also be publicly disclosed.

The LCH Rulebook governs the rights and responsibilities and procedures of LCH and its clearing members in respect of the clearing services provided by LCH, and sets out the day to day operation of the business. In addition, the Rulebook also deals with specific events for example the process for managing a clearing member's default and incidents that may arise and changes to work practices on the invocation of its Business Continuity Plan. LCH makes its Rulebook, membership criteria and risk disclosures available to the public via its website. Regulation 44 sets out how its Regulations and Procedures may be amended.

In developing the Rulebook, LCH works with clearing members to establish prudent risk management rules, in line with industry best practice, including procedures during non-routine, though foreseeable, events.

Members are given a consultation period in which to comment on changes to its Rulebook and the proposed changes are made available via the secure clearing members' area of the LCH website. All proposed rule changes that have been filed with the CFTC are made publicly available on LCH's website.

The Rules Change Committee oversees LCH's rule implementation process and establishes the rule consultation and amendment process for all rule amendments, including material rule changes. Following a determination by the Committee, based on materiality, of the period required for consultation, a period of consultation with LCH's clearing members will commence in order to provide clearing members with the opportunity to comment on proposed rule amendments. Prior to presentation at the Committee there may be an internal peer review with Legal and Compliance Staff, or for significant rule changes, a review will be carried out by external lawyers to ensure clarity. The Rules Change Committee ensures that rules are clear and comprehensive by discussing each rule change in full and by means of challenge.

LCH's key policies are reflected in information available on LCH's website. This includes the expected coverage of initial and variation margin requirements, acceptable collateral and haircuts, and participation requirements.

Key Consideration 2: An FMI should disclose clear descriptions of the system's design and operations, as well as the FMI's and participants' rights and obligations, so that participants can assess the risks they would incur by participating in the FMI.

The Rulebook, explanations of the structure of LCH's default waterfalls, LCH's PPS arrangements, as well as the list of current PPS banks is published on the website. In addition, LCH provides it's clearing members access to margin calculation tools to estimate initial margin obligations for certain markets. For each service that LCH offers, key service features are published on its website. User guides and technical specifications are available on request.

The Rulebook sets out those areas where LCH is entitled to exercise its discretion, as well as LCH's and clearing members' rights and obligations.

Information regarding the technical and operational requirements relating to access to LCH for each service

is publicly available on the LCH website.	
Key Consideration 3: An FMI should provide all necessary and appropriate documentation and training to facilitate participants' understanding of the FMI's rules and procedures and the risks they face from participating in the FMI.	
On becoming a clearing member, training is required for clearing members without previous LCH clearing experience, as LCH requirements state that at least two personnel are fully conversant with clearing procedures. LCH has developed a training curriculum which covers all services. The clearing member on-boarding training covers risk management, margining, collateral operations and reporting. Furthermore, refresher operational training is provided for any existing clearing member on an ad hoc basis, as required. Bespoke training for any element of clearing may be formulated and delivered on request. The Member Training team distributes evaluation forms to all training attendees and collects feedback to make adjustments and improvements to the service and the training material where necessary. Outside of formal training, LCH staff are available to its clearing members and dedicated teams are in place to assist clearing members, where necessary. Contact details are available on the LCH website. If it becomes apparent that a clearing member lacks understanding of a particular element of the clearing process, the clearing member is contacted to discuss the requirement for further training.	
Key Consideration 4: An FMI should publicly disclose its fees at the level of individual services it offers as well as its policies on any available discounts. The FMI should provide clear descriptions of priced services for comparability purposes.	
Fees and descriptions of services are disclosed on the LCH website at the level of its individual services and, where relevant, volume-based discounts or fee holidays are clearly stated on the fee page for that service and are offered to all eligible members on a non-discriminatory basis. LCH issues circulars regarding material changes to fees prior to changes being made. In addition, notifications are also posted publicly on the website. This allows for easy comparison across CCPs offering similar services.	
Key Consideration 5: An FMI should complete regularly and disclose publicly responses to the CPSS-IOSCO disclosure framework for financial market infrastructures. An FMI also should, at a minimum, disclose basic data on transaction volumes and values.	
In accordance with LCH's policy of complete disclosure in accordance with the CPMI-IOSCO Disclosure Framework, LCH publishes self-assessments of compliance with the PFMIs and makes quarterly quantitative disclosures under the "Public quantitative disclosure standards for central counterparties". Updates to the self-assessment are made at a minimum every two years or more frequently as required by LCH's national competent authority. Quantitative data such as transaction volumes, notional outstanding values and end of day mark-to-market prices are made available to the public on the LCH website. General information on LCH's activities and operations is publicly disclosed on LCH's website. This information includes a list of clearing members, the set of products cleared, acceptable collateral, and an overview of the overall risk management framework. Also disclosed are clearing fees, minimum default fund contribution requirements, as well as application costs and procedures. This information is disclosed to the public on the LCH website in English.	
Publicly available resources	Governance Rulebook Risk Management Overview

	PPS Arrangements Member Training CPMI-IOSCO Quantitative Disclosure Public quantitative disclosure standards for central counterparties

Principle 24 (Disclosure of market data by trade repositories) is not applicable to CCPs.

Appendix Key terms and abbreviations

Abbreviation	Full name
AMF Québec	Autorité des Marchés Financiers
ASIC	Australian Securities & Investments Commission
ATS	Automated Trading System
BCM	Business Continuity Management
BCP	Business Continuity Planning
BIA	Business Impact Assessment
CaLM	Collateral and Liquidity Management
CCP	Central counterparty
CEA	Commodity Exchange Act
CFD	Contract For Difference
CFTC	US Commodity Futures Trading Commission
CMS	Collateral Management System
CMT	Crisis Management Team
CPMI	Committee on Payments and Market Infrastructures
CRMC	Credit Risk Management Committee
CPSS	Committee on Payment and Settlement Systems
CSD	Central Securities Depository
DCM	Derivatives Contract Market
DCMT	Default Crisis Management Team
DCO	Derivatives Clearing Organization
DFAM	Default Fund Additional Margin
DMG	Default Management Group
DMP	Default Management Process
DVP	Delivery Versus Payment
EMIR	European Markets Infrastructure Regulation

ETCs	Exchange Traded Commodities
ETCMS	Euroclear Trade Capture and Matching System
ETFs	Exchange Traded Funds
EWMA	Exponentially Weighted Moving Average
FCM	Futures Commission Merchant
FINMA	Swiss Financial Market Supervisory Authority
FMI	Financial Market Infrastructure
FSMA	UK Financial Services and Markets Act 2000
FX	Foreign Exchange
FxPAR	Foreign Exchange Portfolio Analysis and Risk
GCM	General Clearing Member
GMRA	Global Master Repurchase Agreement
ICSD	International Central Securities Depository
IOSCO	International Organization of Securities Commissions
ICS	Internal Credit Score
IRS	Interest Rate Swap
ISA	Individually Segregated Account
LCH	LCH.Clearnet Limited
LCR	Liquidity Coverage Ratio
LSEG	London Stock Exchange Group
LSOC	Legally Segregated Operationally Commingled
LVPS	Large Value Payment System
MCLA	Master Clearing Link Agreement
MTF	Multilateral Trading Facility
NDF	Non-Deliverable Forward
NLX	Nasdaq OMX NLX
OTC	Over-The-Counter

OSA	Omnibus Segregated Account
OSC	Ontario Securities Commission
PAIRS	Portfolio Approach to Interest Rate Scenarios
PFE	Potential Future Exposure
PPS	Protected Payments System
Reserved Matters	Certain matters which must be approved by the LCH Board, and which cannot be delegated to the LCH executive.
RCH	Recognised Clearing House
REITS	Real Estate Investment Trusts
RTS	Regulatory Technical Standards
Rulebook	The LCH Rulebooks and the procedures contained therein (the LCH Procedures)
SCSC	Security and Continuity Sub Committee
SEF	Swap Execution Facility
Settlement Finality Directive	Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems
SLA	Service Level Agreement
VaR	Value-At-Risk