LLOYD'S

Non-Natural Catastrophe Exposure Management

Market Themes & Best Practice – February 2024

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Foreword

The last five years have offered no shortage of significant non-natural catastrophe (NNC) losses. A multi-billion pound global pandemic; conflict in Ukraine; cyber attacks: NNC risks have the potential to create a material impact on earnings. It's therefore imperative that we – as the world's leading (re)insurance marketplace – learn the lessons from these events and take prudent steps to understand our exposures.

The Lloyd's market has been developing its approach to the management of natural catastrophe risk for at least the last 25 years; but broadly speaking, the classes affected by NNC scenarios have less mature exposure management than we tend to see for property classes. There are, however, pockets of excellence. For example, in geopolitical risk we are confident that the market is managing its exposures appropriately and is able to withstand an extreme event. For aviation classes, a number of syndicates have demonstrated the innovative tools and systems they can use to track aircraft, enabling analysis by airport, city, country and more. Most importantly, firms are making underwriting decisions based on their aggregations. This is an excellent example of embedding lessons learnt.

However, these pockets of excellence sit alongside areas for material improvement. At Lloyd's we want to support the market to improve NNC exposure management, so our market is seen as a centre of excellence for catastrophe risk of all varieties. Natural and non-natural catastrophe risk management both form part of Lloyd's Principles Based Oversight (PBO) – so we'd like to see all syndicates meeting expectations in these crucial areas, backed by the investment needed to support this leadership ambition.

We recognise that there is still work to do to get the market to where we want it to be in this field. We also appreciate the wider complications involved, including a wide range of types of NNC risk and the often fast-moving risk landscape, which make it more challenging for syndicates to understand and quantify risks with the sophistication achieved for natural catastrophe risk. We want to share the insights we've gained from speaking at length with the whole market on approaches to NNC exposure management, to provide support to help achieve this centre of excellence status.

Based on the Principle 2b reviews performed by Lloyd's Exposure Management team over the course of 2022 and 2023, this document is intended to provide examples of current best practice, with a clear focus on outcomes. We would like this to serve as a reference for syndicates who are seeking ways to actively improve their own understanding and management of NNC risk. I hope you will find this useful as a tool for identifying where to focus attention and investment.

For further information or to discuss specific capabilities at syndicate level, please contact your usual Lloyd's Exposure Management Manager.

Emma Watkins, Head of Exposure Management & Aggregation, Lloyd's

1. Market Themes

The NNC review work performed by Lloyd's Exposure Management in 2022 and 2023 surfaced some overarching market-wide themes. This section discusses some of the thematic challenges that the market is facing, as well as some of the high-level best practice that was observed.

1.1 Thematic Market Challenges

NNC exposure management is in its infancy

- Until recent years, NNC exposures were often managed exclusively by underwriters and actuarial teams.
- This responsibility is now moving, with centralised ownership of these risks and exposures across a portfolio becoming the responsibility of exposure management teams.
- NNC systemic loss potential has historically been less well understood than property catastrophe loss potential, both in terms of the breadth and quantification of events. Where efforts *were* being made to consider systemic loss potential in more depth, there typically wasn't a defined framework in place to incorporate it into decision making.
- Exposure management teams are familiar with probabilistic natural catastrophe models within exposure management frameworks. Probabilistic and deterministic NNC models do exist for some lines of business, and syndicates are now evaluating these models while taking into consideration their coverage, which isn't comprehensive.

Availability of staff and resource for NNC within exposure management

- As exposure management teams take more responsibility for centrally managing NNC risks, they are upskilling and investing in NNC exposure management expertise.
- NNC-specific roles are emerging in the market, although there remains a lack of rounded, experienced individuals. Often these roles are filled with expertise outside of pure exposure management backgrounds.
- Incorporating knowledge from outside of exposure management is also actively promoting cross-team-collaboration within syndicates.

Standardisation and accessibility of exposure data, and changing policy coverage

- A variety of different NNC datapoints are being collected across the market.
- There isn't a single standardised data schema being used throughout the market.
- Lack of consistency and clarity in downstream use (e.g. for input into third-party models).
- There are initiatives in the market to create standardised data schemas – e.g. Open Data Standards ("ODS"), and Lloyd's minimum data standards for Cyber and Liability, but adoption will take time, especially where legacy data is concerned.

Accessibility:

- Data is now being captured digitally, but this has not always been the case.

  - There are some policies with trigger types (such as occurrence form wordings) that are still subject to potential latency claims, and where the policy data hasn't been digitised or isn't immediately accessible for the purposes of exposure management.

- Policy Coverage:

  - Policy coverages and exclusions have evolved, often in response to specific events and claims.
  - Syndicates need to be able to capture the policy coverage accurately in their data to assess real exposures to events.

Lack of NNC event experience, and expert judgement governance

- Probabilistic and deterministic models for NNC are available to syndicates. Where syndicates are evaluating these tools, validation frameworks are being developed to ensure that their coverage is fully understood, and that the approaches are appropriate for use in informing decision making.
- More widely across the market, validated third-party models are being used as an alternative View of Risk ("VoR") to test existing methodologies.
- Quantification approaches are often based on actuarially-derived loss curves, validated using deterministic events. These are typically heavily reliant on expert judgement, due to a lack of NNC event experience. This will evolve as more events occur and as stochastic models develop further. However, it is vital that expert judgements are supported by comprehensive governance: consistent documentation, formulated with clear justification and challenge by a range of experts and viewpoints, and sensitivity tested.

Rapidly evolving NNC threat landscape

- NNC risks are not solely parameterised by geography. They are often network-based or driven by human relationships and behaviours which are highly dynamic and can be difficult to predict.
- Syndicates need robust emerging risk approaches to stay abreast of the NNC risk landscape. A forward-looking approach to identifying, assessing and addressing these risks is very important.

1.2 Overarching Best Practice

As NNC exposure management practices develop, the sophistication of tools and approaches will also develop. Therefore, the "best practice" identified here should be considered as *current* market-wide best practice, as-at the date of this report. It is expected that the market will continually develop and improve their approach to NNC exposure management over time, and Lloyd's oversight and view of best practice will move in line with increasing sophistication in the NNC space.

We explore here the overarching best practice that was identified during the 2022/2023 review process:

Tiered risk appetites & tolerances

- Some of the most sophisticated approaches to setting risk appetites and risk tolerances considered deterministic, probabilistic and limit-based approaches to managing accumulations.
- Most syndicates were developing frequency/severity curves within their internal models and using deterministic scenarios to either test these or as a basis for this development.
- More sophisticated approaches used a wide range of portfolio-specific scenarios.
- Syndicates with the most sophisticated approaches had also adopted other metrics to check accumulations, in addition to deterministic scenarios and frequency/severity curves.
- Higher-level, more rigid risk appetites were often supported by more granular and dynamic risk tolerances. Working in tandem, these supported decision-making from point of underwriting to portfolio management, ensuring that ultimate risk appetites were adhered to.

Continual improvement of data

- NNC data is a key focus across the market, and there are particular challenges around understanding exposure, especially legacy exposure. Best practice does not allow poor or missing data to justify avoiding the risk quantification process; instead, assumptions are applied, documented and justified.
- The most sophisticated syndicates had a plan in place to improve data accuracy, appropriateness and completeness. They were also monitoring progress against these plans and reporting this on a regular basis to ensure that data quality was understood by those using it for decision-making.
- Some best practice approaches to data management included:
  - Availability: data was held in a structured, digital format, easily accessible for interrogation.
  - Quality: data was relevant, accurate and substantially complete.
  - Augmentation: where data was lacking, efforts were made to supplement it with third-party data sources where appropriate.
  - Some syndicates were working towards a “single version of the truth” and straight-through-processing, to facilitate centralised data that can be accessed by multiple parties with minimal manual processing.

Uncertainty: variety of scenarios, back-testing, stress-testing, expert judgement review

- Syndicates attempted to mitigate the extent of uncertainty within NNC risk by using a variety and number of different realistic and extreme scenarios when parameterising and testing their internal model curves.
- When actual events did occur, those with good feedback loops in place incorporated these claims into their NNC exposure management frameworks to actively sense-check their VoR and adjust where appropriate.
- Given the lack of systemic events to-date, a robust program of stress testing the VoR was being used to help quantify the extent of uncertainty and give comfort that small changes to potential events won’t result in shock losses.
- Quantification of NNC losses both as inputs to the internal model and within the internal model itself were heavily supplemented with expert judgements. Regular and critical review of expert judgements and their impacts on modelled NNC losses was therefore key, with these being owned, understood, challenged, validated and updated as appropriate.

Incorporating emerging risks

- The emerging risk landscape is continuously changing with the evolution of technology, social factors, systemic linkages (the way in which things interact), our general understanding and policy wordings. More sophisticated syndicates had a robust emerging risk framework in place as part of their day-to-day risk management process.
- The most advanced frameworks were focussed on outcomes and related these outcomes to business actions and decision making.
- The process and ownership of the emerging risk framework was very clear and feedback loops provided input into the NNC exposure management process.
- Review of the risk landscape was regular and frequent, and the whole process was dynamic but controlled.

A robust governance process with appropriate challenge

- There were a number of syndicates in the market with good governance in place, with the best examples including multiple different groups reviewing NNC outputs from technical to strategic standpoints, inviting challenge across the business.
- This was further supported by having good feedback loops in place to improve expert judgements, approaches and processes and to incorporate other learnings into the syndicate VoR.
- The ability to make improvements easily and react to challenge was also a common positive factor.

Clear within-team responsibilities and effective cross-team collaboration

– NNC exposure management was in the majority moving towards central ownership by exposure management teams, supporting a more holistic approach which is more in line with what is currently seen for natural catastrophe risk.
– Those syndicates who actively leverage expertise from across the business and facilitate regular and effective cross-team collaboration in relation to identifying, quantifying and managing NNC risks, often scored more highly in Lloyd's assessment.

2. Market Best Practice – Practical Guidance

This section explores in more detail the types of best practice exhibited by syndicates that have been rated as 'Advanced'. It will broadly summarise sub-principle level approaches, to provide the market with examples of Advanced practical NNC exposure management.

It is important to note that not all syndicates rated as Advanced are performing every single element of best practice identified here. In line with Principles-Based Oversight, this is not a "checkbox exercise". All syndicates will however have demonstrated that they have a robust approach in place, which is appropriate for their business and delivers the desired outcomes.

This section of the report should provide the market with some insight into what is possible and could be applied in practice at syndicate level in the present day. It is discussed in terms of outcomes and best practice examples.

2.1 Sub-Principle 1: Cat Risk Appetites & Tolerances

Focus on: managing NNC catastrophe exposure in line with agreed risk appetites and tolerances

Multi-dimensional NNC risk appetite frameworks to avoid unforeseen accumulation risk

- Employing a mixture of risk appetites and tolerances within a wider tiered NNC appetite/tolerance framework. There is consideration of materiality of different NNC lines of business and perils.
- Risk appetites and tolerances work together to ensure that a syndicate is guarding against any unforeseen accumulations. This could include using a mixture of tiered quantification approaches such as:
  - Probabilistic methods – using third-party vendor models, actuarially derived exceedance probability curves
  - Deterministic methods – suite of scenarios differentiating between core and incidental classes, and ranging in severity
  - Limits-based methods – country, line of business, industry, product type etc.
- Risk appetites are typically static, whilst tolerances can be more dynamic. It is important that there is clarity around which appetites/tolerances cannot be breached, which can be reallocated when needed, and/or which are purely indicative or used in conjunction with others. Where there is some flexibility, this allows a syndicate to respond to external market opportunities, or redeploy tolerances based on current internal utilisations, whilst still supporting overarching risk appetites.
- Appetites and tolerances have been generated having considered the materiality of NNC risk within a syndicate's portfolio, and the different kinds of potential events that might impact the syndicate: earnings events; capital-impacting events; extreme tail events. There may also be consideration of clash.
- Collaborative input as part of the development of risk appetites and tolerances leverages expertise both at a technical and strategic level, helping to ensure metrics are relevant, appropriate, harmonious with one another and relate to business strategy.

Supporting syndicate-specific NNC business strategy using risk appetites

- Risk appetites and tolerances apply directly to the syndicate business strategy (especially where a syndicate is part of a wider group), to enable targeted control and management. This is often demonstrated in part by using the Syndicate Business Forecast (SBF) as an expressed form of risk appetite or tolerance; if the syndicate is part of a wider group, the syndicate SBF will usually feed into wider group-level risk appetites. There may also be other risk appetites and tolerances that are created using the SBF as a foundation.
- Syndicates have considered the granularity of risk appetites and tolerances to enable monitoring and decision-making based on current utilisations. This might differ by line of business, driven by materiality.
- Appetites are set based upon the syndicate's view of NNC risk, ensuring that this VoR is being consistently used across the organisation for decision-making at all levels (from underwriting to strategy).
- The granularity of risk appetites and tolerances supports decision-making that enables the syndicate to remain within overall business strategy. Top-down and bottom-up risk appetites and tolerances are checked to ensure that they align.

Effective use of risk appetites in decision making

- There is a clear method of communicating risk appetites and tolerances (including current utilisation) to all decision makers. This could be via a risk appetite document, written authorities or allocations, and managed using live dashboards, incorporating checks into underwriting systems, marginal impact analysis, regular reporting templates or similar.
- In-house systems ensure that the impact of decision-making on risk appetite metrics and tolerances is clear. Having a referral and escalation process outside of strict authorities can provide flexibility within defined parameters.
- There is clear ownership and accountability for monitoring and managing NNC risk appetites and tolerances across all decision makers at all levels. This could be assigned to individuals or committees; the CUO may own the NNC risk appetites across underwriting, there may be line of business specific limits owned by product leads, or this may be written into underwriting authorities for example.

Effective monitoring and management against risk appetites

- Monitoring against risk appetites and tolerances is performed frequently enough to prevent unforeseen appetite breaches.
- Clear accountability and ownership of specific risk appetites and tolerances provides targeted focus across these key metrics, reducing the likelihood of breaching and increasing the probability of identifying a potential breach before it occurs.
- A structured breach management process is in place to identify where appetite breaches may occur, and to outline mitigative actions to control these situations. An example would be the adoption of a red/amber/green (RAG) traffic light system to track appetite utilisation and to define management actions and responsibilities at each stage.
- Actions can range from triggering more regular reporting to decision makers, to a formal review and potential update to the risk appetite if deemed necessary.
- Risk appetite and tolerance monitoring governance supports visibility across decision makers so that performance is appropriately reviewed and challenged. Appropriate Management Information (MI) is presented to various forums that need to understand performance against appetites from an operational level up to the Risk Committee and Board level.
- Reporting at all levels is provided to understand current utilisations, what this means for the business, what actions to take as a result and who is responsible for managing these actions and owning the outcomes.

Ensuring that risk appetites remain appropriate using feedback loops

- Running pro-forma portfolios including some inherent uncertainty can help set appropriate risk appetites and tolerances for the coming year.
- Defining feedback loops within the business enables continual review of the appropriateness of risk appetites and tolerances. Any proposed updates to risk appetites and tolerances are adequately managed and owned within a defined process.
- Potential triggers outside of regular feedback loops can be considered. These might include a change in business strategy, market movements and opportunities, loss events, reinsurance erosion, new or emerging risks etc.
- Emerging risk framework outputs feed into risk appetite and tolerance setting, to consider whether any additional allowance needs to be made for emerging risks or potential future events.

2.2 Sub-Principle 2: Data & Tools

Focus on: employing appropriate tools to support effective and efficient NNC exposure data capture, management and use

Managing NNC data accuracy, appropriateness and completeness

- There is recognition that data needn't be perfect to undertake exposure management. There does however need to be a thorough understanding of the current data quality, and appreciation of where there are data deficiencies so that appropriate adjustments can be made to address this whilst a program of continuous improvement is being implemented.
- Key NNC data fields are identified as minimum data requirements, and these are systematically collected and stored for the majority of new and renewing business. (Market schemas such as the ODS and Lloyd's cyber and liability minimum data standards are available and free for syndicates to use to support this effort.)
- Data quality controls are defined and used at point of underwriting. If underwriting submissions don't include adequate data, underwriters request more information, and where minimum data requirements are not met, risks may not be quoted.
- Data quality metrics can be played back to data providers such as brokers and coverholders to promote discussion around continual improvement at point of underwriting.
- A process for documenting, controlling and regular monitoring of data quality is in place as part of a wider plan to improve data quality and capture over time:
    - Data entry and validation is defined and performed in a consistent way.
    - Data assumptions are documented and applied consistently.
    - Data flows are clear, and data owners are identified and assigned responsibility to progressively improve NNC data.
    - NNC data accuracy, appropriateness and completeness are reported and monitored over time against defined criteria and are discussed as part of wider NNC governance.
- A proportionate approach to improving legacy data is adopted.
- Technology and tools facilitate data quality reporting and support data improvement.

Managing NNC data limitations

- Data deficiencies are identified, and effort is made to supplement the existing data to address this.
- Data can also be augmented using third-party datasets to provide additional information beyond what has been received by the underwriter.

– An appreciation for the sensitivity of downstream use and decision-making to data inaccuracies and uncertainties will enable appropriate mitigation of this risk. Adjustments can be applied and priorities for data improvement identified.

Using a consistent NNC view of risk ("VoR") and a single view of exposure for downstream decision-making

– Data held within systems is up-to-date, consistent and considered a 'single version of the truth', used for all downstream decision-making. This avoids re-keying data for different use cases, reducing manual processing and improving data efficiency, accuracy and interoperability.
– Effectively communicating the impact of data quality (and sensitivity) to downstream decision makers ensures that this is being considered in the decision-making process. Where data quality issues are identified, an appropriate consideration of resultant uncertainty can be applied.

Supporting efficient and effective NNC exposure management with tools

– Adequate tools are in place to support data capture, management and validation, and risk quantification.
– Systems support a systematic and repeatable way of capturing data, supported by data dictionaries, data validation and data quality reporting and monitoring.
– Ongoing data quality reporting and monitoring is tracked using purpose-built dashboards.
– Decision makers have easy access to data that is consistently represented throughout the organisation in a single place.
– If policy admin and risk exposure systems are held separately, tools are used to reconcile these systems to ensure the data held is consistent. Best practice is to have a fully-integrated policy admin and risk exposure system.
– Risk quantification tools are available and can be used as a basis for a syndicate NNC VoR if appropriately validated, or as an alternative perspective to parametrise or validate their own NNC methodologies or VoR.
– All tools used have been appropriately tested and validated, and are deemed suitable for their use cases.

2.3 Sub-Principle 3: Exposure Monitoring & Reporting

Focus on: adoption of a robust risk-based framework for NNC exposure quantification and monitoring, to support downstream decision making

Implementing a robust, risk-based framework for NNC exposure monitoring

– NNC exposure management is covered within a syndicate's exposure management framework, and documented procedures are available to outline practical management. These link to other areas of the business where there are NNC data flows and interdependencies.
– There are examples where syndicates have explicitly incorporated NNC into their existing NC exposure management framework, so that the approach is consistent.
– The following are included within the NNC exposure management approach:

  – Definition and consideration of materiality in NNC exposure management framework approaches
  – NNC data strategy
  – NNC VoR development and validation processes (including application of assumptions and Expert Judgements and how these are managed)
  – Setting, reporting and managing NNC appetites and tolerances. Involving technical and strategic decision makers in this process. Managing potential breaches via a red/amber/green escalation approach with defined responses to each classification.
  – Articulation of uncertainty and sensitivity (using back testing and stress and scenario testing)

- Consideration of emerging risks (identify, monitor, quantify, report), potential latent accumulations, clash and current and future makeup of the book
- Cadence and detail of reporting on NNC outputs to various committees and other recipients in the business. Ensuring applicability of these reports to decision making processes.
- Control of exposure management NNC outputs to other teams (e.g. Actuarial)
- Establishing clear feedback loops to support continual NNC EM improvement and maintenance of an appropriate NNC VoR
- Clear responsibilities for NNC exposure management output review, governance and sign-off.

Adopting appropriately validated NNC quantification methodologies

- A variety of potential NNC quantification methods are considered. Those that are selected are most appropriate for the syndicate book of business. The process of defining the NNC quantification methodology critically reviews approaches with this in mind and the selected approach is well justified. Decision makers from across the business are included in quantification methodology development where their technical expertise can be leveraged.
- The process of selecting NNC quantification methodologies is managed in line with Sub-Principles 5 (View of Risk Methodology) and 6 (View of Risk Validation).
- NNC quantification methodologies are used consistently across the business to enable decision making.
- An appropriate view of NNC risk is maintained by continually developing understanding of risks through active learning, development and research.

Regular, timely NNC reporting to support decision-making

- The frequency of NNC reporting is defined by cadence required for downstream decision making.
- Reporting content is developed with downstream decision makers and consumers, to ensure that the content is useful and at a sufficient level of detail. Feedback and challenge provided as part of the governance and sign-off process helps to shape reporting requirements over time.
- Key metrics include loss quantification, performance against risk appetites and tolerances, data quality, data adjustments, uncertainties, sensitivities, marginal impact (where possible), suggested actions.
- Regulators are informed ahead of syndicate submissions where there are breaches of approved plan anticipated or where returns may be submitted late.

2.4 Sub-Principle 4: Resourcing & Expertise

Focus on: having the teams and expertise in place to meet NNC business needs, including strategic projects, regular deliverables and research and development

Adequate resource available to meet the following business needs:

- Performing ‘business as usual’ regular-cycle NNC quantification, reporting and providing external team/cross-team support.
- Undertaking research and development to ensure continual improvement of existing NNC exposure management approaches and methodologies in light of the current and future risk landscape.
- Reacting to real-time NNC events and incorporating this experience into the existing EM framework.
- Formulating new and more efficient ways of delivering NNC exposure management insight to the business for both strategic and operational decision making.
- Avoiding key-person dependencies by undertaking inter- and intra-team training and development on related topics, and by effective succession planning.

Varied team expertise

- Teams are made up of either specialists and/or generalists with a range of experience, but the team composition considers the materiality of different NNC lines of business in ensuring appropriate resource is available.
- External expertise and resource can be leveraged. External consultants and group-level research teams have been engaged on specific NNC topics or projects. Third-party offshore teams have been appointed to support NNC data management work.
- Where external resource is utilised, syndicates ensure that deliverables are clear and in line with business requirements by putting in place project plans and SLAs.

2.5 Sub-Principle 5: Cat View of Risk Methodology

Focus on: defining and maintaining an appropriate NNC VoR methodology

NNC VoR development and outputs are robust

- The NNC VoR is appropriate for the business that the syndicate writes and is regularly reviewed and amended as necessary as the portfolio develops over time, to reflect experience, market conditions and portfolio composition.
- Data quality sensitivities are considered and communicated along with NNC internal model inputs. This is especially important where this drives a material impact on model outputs. Deficiencies are addressed and appropriate adjustments made and documented.
- A range of NNC quantification approaches can be utilised as internal model inputs, or as a way of providing alternative views of frequency/severity to validate internal model inputs, and test sensitivity and uncertainty of the NNC VoR.
- Approaches for generating NNC internal model inputs range from using a suite of RDSs to parameterise actuarially derived frequency-severity distributions (ranging in granularity, dependent on materiality), to use of probabilistic outputs from third-party model vendors, which may be adjusted post-validation.
- Other experience, claims, expected loss ratios, external data sources and models are used to inform and validate the syndicate NNC VoR methodology and assumptions.
- Where a suite of scenarios is used, this suite includes a range of different views on loss frequency and severity. This avoids overreliance on any one scenario or group of scenarios and will account for extremes and potential future events emanating from emerging risks.
- To investigate potential clash by correlating across lines of business, NNC internal model inputs are considered at line of business level.
- The NNC VoR goes through a defined governance framework to confirm that the approach is robust.

Exposure management NNC inputs into the internal model are defined, managed, communicated and improved over time

- Expert Judgements (“EJ”s) can be a significant input to NNC risk representation within internal models. Where this is the case, syndicates:

  - Maintain a comprehensive NNC EJ log.
  - Outline within policies how EJs are used within the internal model, evidenced and tested.
  - Define triggers for when an out-of-cycle NNC EJ review should be performed.
  - Conduct at least an annual attestation as to EJ appropriateness.
  - Understand, test and communicate the sensitivities related to NNC EJs.
  - Clearly articulate who owns, reviews and maintains each EJ. Those who own the EJs are ultimately responsible for managing their appropriateness and use.

  - Continually seek improvements in EJs, as solutions and approaches to modelling NNC develop.
  - Include the use of NNC EJs within the in-team testing plan, and critically review these also as part of continuing internal model development.

- There is a single version of the truth relating to exposure management outputs (and NNC feedback loops from internal model outputs), which feeds all downstream decision-making. This ensures consistency across the business and can be facilitated through streamlining systems which contain and deliver this information, and by providing decision makers with access to consistent data and MI.
- All decision makers are aware of the approaches taken and understand their sensitivities and limitations.
- Any material changes in NNC VoR are raised and discussed with Lloyd's ahead of adoption.

2.6 Sub-Principle 6: Cat View of Risk Validation

Focus on: implementation of an appropriate risk-based validation of the NNC VoR , including critical review of exposure management inputs, and internal model outputs used for decision making

Multiple validation points to ensure ongoing NNC VoR appropriateness

- Additional data is used in validation, including third-party model views as an alternative VoR, internal and externally created RDSs (i.e. an extended suite of scenarios), experience and other external sources.
- Emerging risks are considered in validating the NNC VoR. Potential impacts of emerging risks are investigated using new scenarios, and these are used to test the VoR. An emerging risk group within a syndicate can attest to NNC VoR completeness.

Adequate governance to critically review the NNC VoR

- Clear ownership of the NNC VoR and its use. NNC VoR is developed using subject matter experts but is owned and managed centrally to facilitate consistent use across the business and ongoing improvement.
- Independent validation testing is performed by second line of defence teams, supported by third-party external validation testing. NNC VoR is considered in all testing plans.
- Independent review of underwriting decisions based on NNC VoR outputs. Peer review and challenge provided at policy level.
- Exposure management teams participate in committees involved in the NNC VoR sign-off process.
- All teams with specific NNC expertise feed into critical review of the NNC VoR through the governance framework. NNC VoR feedback is incorporated into future development work.

Incorporating uncertainty and sensitivities into NNC VoR outputs

- The capital model validation process includes sensitivity and stress and scenario testing to ensure that the NNC VoR is reasonable and appropriate for the syndicate's portfolio.
- Where there is experience that can be used, back testing is used to help validate the VoR. This links with other areas of the business.
- NNC model assumptions are tested to quantify and communicate the sensitivity of VoR outputs relating to these assumptions. Uncertainties and sensitivities are built into reasonableness testing for NNC.
- An example approach to managing uncertainty and sensitivities would be to undertake an annual extreme sensitivity test against all NNC scenarios, to review and assess the resultant movement in capital (direction and quantum) directly associated with NNC VoR. All key assumptions are stress tested annually. RDSs and EJs are stressed annually, and the impacts and sensitivities are logged and communicated to all decision makers.
- All decision makers are aware of the NNC VoR uncertainties, sensitivities and limitations.

2.7 Sub-Principle 7: Cat View of Risk Completeness

Focus on: maintaining a materially complete representation of NNC in the syndicate VoR

Clear methodology to review and test NNC model completeness

- Any areas which could impact NNC model completeness are identified, and a plan put in place to mitigate deficiencies. The approach is clearly considered, documented so that it is repeatable, approved by relevant committees and communicated to decision makers.
- A risk-based approach is adopted, and for all material lines of business an appropriate representation of the range of potential losses, uncertainties and sensitivities are included in the NNC VoR.
- Some model completeness elements are economic or social and therefore can impact multiple lines of business e.g. inflation. These risks are identified and considered as part of model completeness. There is clear responsibility for managing, quantifying and including these risks within exposure management inputs and the internal model to ensure adequate representation while avoiding double counting.
- If there is long-tail exposure from policies written in prior years, this is accounted for in the NNC VoR.

Model completeness owned and managed as part of the governance framework

- NNC model completeness adjustments are adequately discussed, documented and regularly reviewed via the governance framework.
- NNC model completeness may be wrapped into the existing internal model governance process and internal model validation process, to ensure consistency in approach and Solvency II compliance.
- A consistent and joined-up approach to ensuring NNC model completeness across teams is needed. Some model completeness elements may be captured by exposure management, some by capital, some within reserve inputs or underwriting inputs etc.

Ongoing regular review of NNC model completeness appropriateness

- Model completeness is considered and critically reviewed on an ongoing basis as part of the NNC VoR framework. There are also triggers for review to ensure that the VoR remains complete when changes occur to the risk profile, or with the emergence of new risks.
- The emerging risk process feeds into the syndicate's understanding of model completeness. Clear thresholds identify when an emerging risk moves from being of interest to requiring quantification and inclusion within the VoR.
- NNC VoR model completeness is considered in detail by capital and exposure management teams as part of validation work. It is explicitly built into the process and considers EM inputs into the internal model as well as completeness of the representation of risk within the internal model itself.

Consideration of future events with a forward-looking methodology

- Experience can be used to test the NNC VoR, but potential future events (considering "what is possible") are also included to help parameterise uncertainty and sensitivities.
- Syndicates can consider model completeness in terms of the impact on business plans (testing how model completeness assumptions impact the future VoR), and also by feeding in outputs from emerging risk groups in the same way.

2.8 Sub-Principle 8: Cat View of Risk & Methodology Change

Focus on: adopting a robust risk-based framework for managing changes to NNC VoR and exposure management methodologies; identifying, actioning, communicating and integrating these changes

Managing NNC VoR and methodology changes

- Proposed updates to the NNC VoR or methodology are managed centrally with clear accountability and ownership. Those responsible leverage feedback loops within the syndicate to inform a process of ongoing review.
- Any changes undergo a period of testing to fully understand downstream implications before being implemented for decision making. Subject matter experts and other teams feedback on proposed changes prior to implementation.
- NNC VoR and methodology changes are considered as part of a wider syndicate model change framework, with defined triggers and actions to be taken when making updates. Example triggers for review could include major market events, adoption of new models or approaches, incorporation of loss experience, risk profile changes, inclusion of emerging risks, updates to EJs etc.
- Model change is also considered in conjunction with the model validation policy to ensure there is consistency in approach to developing the NNC VoR both initially, and over time as sophistication of quantification and understanding of risk improves.

Robustly testing new NNC VoR and methodologies prior to implementation

- Testing of NNC VoR and methodology changes is managed in line with Sub-Principle 5 (View of Risk Methodology) and 6 (View of Risk Validation).
- Methodologies are reviewed and challenged by experts and flow through a defined governance structure.
- Impacts of proposed changes are clearly defined, tested and communicated to decision makers for challenge and agreement prior to adoption.
- Robust testing of any changes to the NNC VoR and methodologies includes consideration of uncertainty, sensitivity and interdependencies with existing EJs which might require resultant updates.
- The internal model can be run ad-hoc when inputs or assumptions are updated or to test wider changes to approach prior to adoption. These changes are considered as part of overall syndicate model change and validation frameworks.

Communicating impacts of NNC changes to decision makers

- Changes should be clearly documented, and downstream impacts on decision-making and model outputs well communicated so that any decision makers using the output are aware of a change in methodology, and how this might impact their decision making.
- The impact of updating NNC VoR and methodologies is fed through into decision-making frameworks such as risk appetites and tolerances, and these are updated to reflect changes where appropriate.

2.9 Sub-Principle 9: Cat View of Risk Use

Focus on: maintaining consistent understanding, use and continual development of outputs in decision making processes i.e. underwriting, portfolio management, strategy, capital setting, risk transfer etc

Consistent view of NNC risk used in all downstream decision-making

- NNC analytics, and NNC internal model outputs are integrated with (and support) decision-making across underwriting, portfolio optimisation, business planning and strategy and capital setting.
- The view of NNC risk should be consistent across the business, feeding into and supporting all downstream decision-making.
- Linked systems with automatic data feeds help facilitate consistent downstream use of these outputs.
- A syndicate's internal model is a working model which can be rerun as and when required. There are triggers set for capital reassessment which include changes in NNC internal model inputs. Having linked data feeds and degrees of automation allows updates to the current portfolio to be made in a timely way.

Appreciation of NNC VoR limitations and adjustments in decision-making

- Training is provided across decision-making teams to ensure there is adequate understanding of NNC internal model input requirements and outputs, including how these should be used and the uncertainties and sensitivities around them.

An effective NNC event response strategy is in place

- NNC event response plans are documented and include input from exposure management, claims, underwriting, capital, reserving and senior management.
- In the early stages of an event, a wide range of outcomes and associated uncertainties are considered.
- As an event progresses, feedback loops are in place to inform current modelling assumptions, VoR and outputs. Suggested improvements are scheduled and tracked.
- Post-event, back testing using claims experience contributes to more robust NNC parameterisations, VoR validation and refinement where appropriate.
- Post-event retrospectives are anticipated to consider:
    - Counterfactuals i.e. consideration of how much worse the event 'could have been'.
    - Whether there are outstanding claims that could occur post-event, what these might look like and the quantum of associated losses.
    - Downstream business impacts such as changes in policy wordings, expansions or restrictions of coverage, impacts on risk appetites and/or wider implications such as inflation or recession.
    - Any actions relating to updating or validating the NNC VoR based on event experience i.e. a review of trends and event frequencies, or updates to defined EJs.

Incorporation of feedback loops into ongoing NNC VoR development

- Feedback loops from all NNC VoR business users are live, clear, tracked and managed. It is important to ensure that conversations about the NNC VoR aren't one-directional. This supports testing of new strategies, impacts of underwriting decisions, reaction to and anticipation of changing market conditions or changes to the NNC VoR.
- Where outputs don't fit with expectations or current understanding this is investigated, and a decision made as to whether an update is required.
- Defined triggers identify where a NNC VoR review may be required.
- Loss ratio and claims information can be used in annual benchmarking work. This information provides a good validation point NNC loss picks.

- NNC VoR is included in the areas of the internal model that receive targeted testing as part of scheduled validation work. There is a consideration of materiality in terms of review frequency, or other triggers (e.g. change in portfolio mix) which might lead to targeted review/testing. A schedule of development with timed deliverables would be compiled after such a review.
- The internal model can be run as an 'as-if' on an ad-hoc basis to test the impact of VoR adjustments prior to implementing a decision or strategy.

2.10 Sub-Principle 10: Governance & Oversight

Focus on: having robust governance and oversight of NNC risk aggregations in place via a framework, which delivers challenge and expertise to ensure that the NNC VoR remains appropriate to continue to support business decision making

Robust governance to provide targeted NNC review and challenge

- Exposure management frameworks define a clear NNC-specific governance and decision-making authority structure. This may dovetail with any existing NC framework, but NNC is discussed explicitly.
- Multiple levels of both technical and strategic review are adopted.
- NNC decision-making committees include representation from across the business.
- Committee terms of reference communicate decision-making authorities and responsibilities. Escalation criteria can also be defined to ensure that the flow of NNC information between committees is appropriate.
- There is a structure in place to communicate and escalate issues through technical committees, risk and capital committees and up to the Board.

Adequate understanding of NNC outputs to support decision-making

- Those reviewing and using NNC exposure management outputs have sufficient understanding to be able to provide challenge and objective feedback on both quantitative outputs and the approaches adopted to identify, quantify and monitor NNC risk. This includes appreciation of limitations and uncertainty.
- Training is provided to decision makers via targeted sessions and facilitated thematic discussions.
- Training, information-sharing and thematic discussions are tailored to the audience, dependent on their decision-making responsibilities and the required depth of understanding.
- Forums used for NNC decision-making meet at a frequency that is defined by business requirements. Technical committees may meet more frequently than strategic committees. There may be regularly scheduled meetings as well as clearly defined triggers for ad hoc meetings e.g. following an event or when implementing a change in approach.

Ensuring NNC exposure management processes remain appropriate over time

- As approaches to NNC exposure management develop, syndicates similarly develop their oversight and governance frameworks to ensure that they remain adequate. This is communicated via existing feedback loops between teams and committees, as well as through more formal review.
- Regular cycle and ad-hoc reviews are used to identify where improvements could be made. This can involve the second and third lines of defence, and as required, external third-party input.
- Approaches vary from reviewing exposure management input into class of business level audits, through to focused audit of the exposure management function (including NNC management).
- Where targeted reviews are performed, materiality of risk may play a part in defining cadence and scope, with approaches to more material risks being reviewed more frequently and in more depth.
- Any recommendations made are discussed within the committees they impact, and a clear plan is put in place to make and own the necessary improvements.

3. Conclusion

This document shares an outcomes-focused approach to current NNC exposure management best practice, exhibited by syndicates that have been rated as ‘Advanced’ for Lloyd’s Principle Dimension 2b (NNC). Lloyd’s expects syndicates to make appropriate investments to progress NNC exposure management and for these practices to be increasingly commonplace across the market. Syndicates should all be Meeting Expectations and striving for continuous improvement as our understanding of NNC evolves, in the same way that practices have continued to develop for natural catastrophe exposure management.

As a starting point, syndicates should be developing and using their own scenarios for analysis, interpretation and internal reporting. These should be forward-looking, considerate of a syndicate’s own portfolio, and appropriate to the dynamic nature of NNC risk. This requires thinking creatively to design plausible but extreme scenarios that would impact portfolios in a way not directly experienced before. It also requires maintaining a robust approach towards ensuring appropriate data quality and capture. These scenarios can then be used to develop multi-dimensional risk appetites.

Syndicates should be incorporating feedback loops within their organisations that allow for NNC understanding and expected loss analysis to be consistently factored into other decision-making areas of the business such as pricing, underwriting, reserving and capital. The need for feedback loops extends to reinsurance; syndicates should ensure that the impact of wordings and coverage is traced through and properly accounted for in net exposures. Given current reinsurance market conditions, this is more important now than ever.

Across all of the above, syndicates must have a robust governance framework in place that allows for challenge and sharing of expertise to ensure that the NNC VoR remains appropriate to continue to support business decision making.

Syndicates should ensure that their exposure management frameworks robustly consider both natural-catastrophe and NNC risk. Approaches may differ, but syndicates should do the best they can to ensure that their approach adequately considers the dynamic nature of NNC risk, and that quantification approaches are appropriately justified and are proportionate to the book of business. The Lloyd’s market will work to continually improve NNC exposure management, and to showcase this conscious effort to lead against other markets with our innovation, knowledge and expertise, as a true centre of excellence.

4. Useful Links

Lloyd's webpage for the Principles for Doing Business. This includes the NNC Maturity Matrix (contained within the Principles & Maturity Matrix document) and the latest Materiality Metrics used to calculate Expected Maturity.

Principles for doing business at Lloyd's (lloyds.com)

ODS (Open Data Standards)

https://oasislmf.org/open-data-standards