



# **Bank of China New York Branch Model Risk Management Policy**

**Enterprise Risk Management**


**February 2021**

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## 1. Executive Summary

The Model Risk Management (MRM) Policy (the “Policy”) establishes the standards for Bank of China New York Branch and its satellite branches (collectively “BOCNY”) related to the responsibilities of all roles ([defined in section 2.3](#)) involved in the model risk management process for models used by BOCNY.

This Policy adheres to the defined standards in BOCNY Risk Governance Framework Policy (RGF) for managing model risks, including identifying, assessing, controlling, monitoring, reporting, and escalating.

### 1.1. Purpose

The purpose of the Model Risk Management Policy is to set out a comprehensive framework for managing model risk throughout BOCNY’s business activities and organizational structure, in a manner that is designed to be consistent with the principles of the Supervisory Guidance on Model Risk Management (OCC 2011-12 / SR 11-7).

Use of models exposes BOCNY to “**model risk**”, which is the potential for adverse consequences from decisions based on incorrect or misused model outputs and reports. Model risk can lead to financial loss, poor business and strategic decision making, or damage to a bank’s reputation. Model risk can occur for a number of reasons, the two primary ones are as below:

- The model may have fundamental errors and may produce inaccurate outputs when viewed against the design objective and intended business uses. The mathematical calculation and quantification exercise underlying any model generally involves application of theory, model assumptions, choice of sample design and numerical routines, selection of inputs and estimation, and implementation in information systems. Errors can occur at any point from design through implementation.
- The model may be used incorrectly or inappropriately. Even a fundamentally sound model producing accurate outputs consistent with the design objective of the model may exhibit high model risk if it is misapplied or misused. Models by their nature are simplifications of reality, and real-world events may prove those simplifications inappropriate.

### 1.2. Scope

The Policy establishes standards for BOCNY related to first, second, and third lines of defense responsibilities for model risk management.

The scope includes models (refer to model definition in [section 2.1](#)) that are internally-developed by BOCNY, Head Office (HO), developed by a third party specifically for BOCNY, or represent off-the-shelf vendor systems used by BOCNY. The model risk is embedded in the uncertainty of the model nature which varies by specific judgments, assumptions, estimation methodology or approach used, they require more specialized technical (e.g., financial, economic, statistical, and/or computational) oversight to control the associated model risk.

Models that are developed for a single-time use in support of critical business decisions are also in scope of the Policy.

The Policy does not apply to those computational processes that use simple arithmetic calculations or unambiguous rules, and that do not include assumptions or judgments; and do not produce uncertain values regardless how many computational steps involved in the process.

### **1.3. Policy Governance**

#### **Overall MRM Approval and Escalation Framework**

Enterprise Risk Management MRM function creates and owns this MRM Policy. This policy is reviewed and approved by Operational Risk Committee (ORC) and ultimately by Risk Management and Internal Control Committee (RMICC). ORC approves MRM procedure, model inventory change and MRM exceptions. Model validation results, and any model risk reporting/escalation will be reported to ORC, and issues/breaches could be escalated to the RMICC as necessary (e.g. if they remain unresolved).

#### **Risk Management and Internal Control Committee (RMICC)**

The RMICC is a management-level committee of BOCNY with responsibility for overseeing risk management practices of the Branch. The RMICC reviews and approves the Branch's major risk management and internal control policies and procedures. In addition, the RMICC implements the instructions and decisions of the USRMC with regard to model risk management, and reviews and approves MRM Policy as least annually.

#### **Operational Risk Committee (ORC)**

The Operational Risk Committee (ORC) is a subcommittee of the Risk Management and Internal Controls Committee (RMICC). ORC reviews and approves MRM procedure, model inventory change and MRM exceptions. A list of model risk reporting item to ORC is defined in MRM procedure.

#### **Related Policies and Procedures**

In order to strengthen the model risk management practices of BOCNY, this Policy should be read in conjunction with other BOCNY's policies which are developed in accordance with the OCC Heightened Standards and other related regulatory guidance. Other related policies include, but are not limited to:

- Bank of China US Branches Model Risk Management Procedure
- Bank of China US Branches Risk Governance Framework
- Bank of China US Branches Operational Risk Management Policy
- Bank of China US Branches Data Governance Policy
- Bank of China US Branches Key Risk Indicator Procedure
- Bank of China US Branches Bulk Purchase Review Committee (BPC) Policy
- Bank of China Third Party Risk Management Procedure

## 2. Model Risk Governance

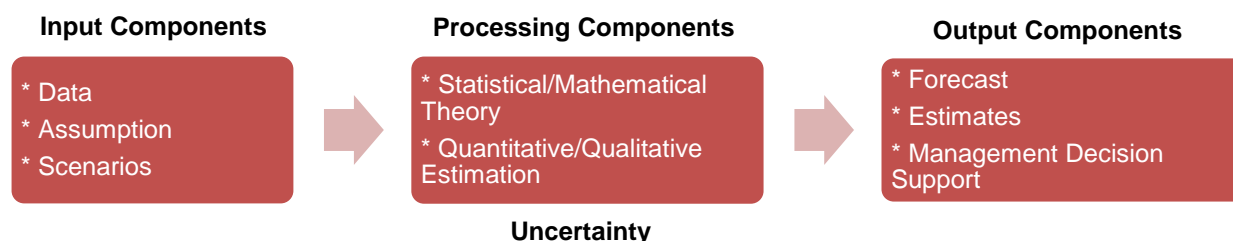
### 2.1. Model Definition

The term “Model” refers to a method, system or approach that applies statistical, economic, financial or mathematical theories, techniques, and assumptions to process inputs to quantitative or qualitative outputs. A model consists of three components:

- An **input component**, which delivers assumptions and data to the model;
- A **processing component**, which transforms inputs into estimates and is associated with certain level of uncertainty;
- An **output and reporting component**, which translate the estimates into useful business information. Although most models are quantitative in nature, model inputs and outputs can also be qualitative (such as expert judgement).

Models meeting this definition might be used for analyzing business strategies, informing business decisions, identifying and measuring risk, valuing exposures, instruments or positions, conducting stress testing, assessing adequacy of capital, managing client assets, measuring compliance with internal limits, maintaining the formal control apparatus of the bank, or meeting financial or regulatory reporting requirements and issuing public disclosures.

**Figure 1: Key Components in a Model**

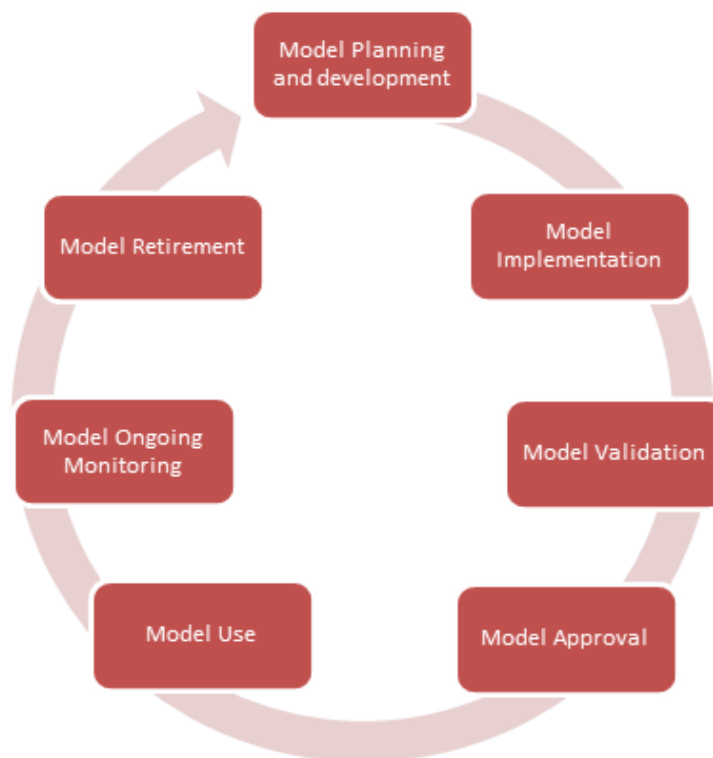


MRM function provides the questionnaires as a guidance to help MRM stakeholders to identify potential models which is in [Appendix A](#).

## 2.2. Model Lifecycle

The first step in a model lifecycle is **planning and development**, which is a joint effort among different stakeholders, usually through a workshop. After the methodology is finalized, the model is **implemented** by implementer. Before the model is deployed to production, the model details need to be submitted by the model owner to MRM function to go through the **model validation** and **approval** process. The model submission requirements are detailed in [Appendix B](#). After MRM function's official approval, the model could be used in daily business with appropriate **ongoing monitoring** until the model is replaced by a new model or decided not to be used in any occasions, meaning **retired**. A model's lifecycle is shown in the following figure.

**Figure 2: Model Lifecycle**





## 2.3. Roles and Responsibilities

Contained within this section is a detailed definition of roles and responsibilities related to the MRM framework across the whole model lifecycle.

The overall objective in managing roles and responsibilities in the lifecycle pertaining to MRM function is to ensure alignment of responsibility and authority as well as to identify potential conflicts of interest that must be addressed. Generally, the MRM roles fall into three broad categories following the three lines of defense framework outlined in the previous section.

### 1) First Line of Defense - Model Owner, Developer, Implementer and User

- Model Owner serves as 1<sup>st</sup> line of defense in managing the model risk, no matter which departments they belong to. Model Owner is ultimately accountable for all aspects of the model risk that may arise through the model lifecycle. Each model should have one department assigned as the Model Owner. The responsibilities of model owner naturally go to department head, and department head can delegate to another person (VP above) who is qualified to conduct the functions as behalf of Model Owner.
- Model User is generally the business or control function that relies on the model's output and has accountability for working with the Model Owner to ensure proper model use.
- Model Developer and Model Implementer can be either the same party or different ones. Both roles are responsible to the Model Owner in ensuring that the model is theoretically sound and well implemented with proper controls and clear understanding of its limitations.

### 2) Second Line of Defense - Model Risk Governance and Validation

- Enterprise Risk Management MRM function owns MRM framework. This includes all functions involved in identifying, assessing, mitigating, monitoring, and reporting on model risk as per MRM policy and procedures. There are typically two sets of roles with tight interconnectivity but slightly different areas of focus: model risk governance and model validation.

### 3) Third Line of Defense-Internal Audit

- Internal audit periodically assess the design, effectiveness and sustainability of the MRM framework.

The **RMICC** is a BOCNY management-level risk committee with responsibility for overseeing risk management practices of the branch, which guides MRM Policy and serves as the final decision-making authority for escalated model risk issues. The ORC is a subcommittee of the RMICC. **ORC** reviews model risk reporting and advises on escalated issues before RMICC.

The MRM governance roles and responsibilities are outlined in the Table below:

**Table 1: Roles and Responsibilities in MRM**

Role	Responsibilities
<b>Model Owner</b>	<ul style="list-style-type: none"><li>• Coordinate with all MRM stakeholders and be responsible for the entire model life cycle</li><li>• Submit the model submission package in line with the requirements defined by BOCNY MRM procedure, also listed in <a href="#">Appendix B</a>.</li><li>• Coordinate with different MRM roles to remediate internal (e.g. Model Validation and Internal Audit) and external (e.g. Regulators) findings</li><li>• Coordinate with Model User to monitor model performance and report issues to MRM</li><li>• For Head Office models, there should be a local model owner assigned to fulfill model owner's responsibilities</li></ul>

<b>Model Developer</b>	<ul style="list-style-type: none"> <li>• Conduct model development and improvement activities under the directions of Model Owner with qualified skills for the specific model</li> <li>• Models could be developed by internal model developers, external vendors or Head Office (HO)</li> </ul>
<b>Model Implementer</b>	<ul style="list-style-type: none"> <li>• Establish an infrastructure and control process /testing to ensure the model functions properly</li> <li>• Ensure the data and output integrity through the related systems</li> </ul>
<b>Model User</b>	<ul style="list-style-type: none"> <li>• Assume responsibility in using the model and interpreting the model outputs for appropriate business purpose</li> <li>• Participate the ongoing monitoring to ensure the appropriateness of model use in specific business area</li> </ul>
<b>Enterprise Risk Management- Model Risk Management function</b>	<ul style="list-style-type: none"> <li>• Develop, implement and maintain the MRM framework for BOCNY, including governance, policy and procedure</li> <li>• Conduct model identification, model review and model validation</li> <li>• Define model risk metrics and provide regular model risk reporting to Senior Management</li> <li>• Address relevant issues raised by internal audit and external regulator</li> </ul>
<b>ORC</b>	<ul style="list-style-type: none"> <li>• Review model risk report and address escalated issues</li> <li>• Approve MRM Procedure, model inventory change and MRM exceptions</li> </ul>
<b>RMICC</b>	<ul style="list-style-type: none"> <li>• Perform as a decision making channel for model risk management stakeholders to approve MRM Policy, and perform as final decision making authority for escalated model risk issues</li> <li>• Review MRM RAS KRI breaches</li> </ul>
<b>Internal Audit</b>	<ul style="list-style-type: none"> <li>• Verify the consistency between MRM activities with MRM policy and regulatory requirements</li> <li>• Verify MRM framework is well designed, effectively implemented and sustainably maintained</li> </ul>

## 2.4. Model Risk Exception and Escalation

Breaches to the MRM policy and procedure are referred to as exceptions, which need to be monitored, reported and escalated. Such exceptions include but not limited to the following:

- Breach of the new model validation requirements, i.e. new model goes into production without MRM validation and approval
- Breach of the model inventory attestation requirements, i.e. knowingly omitting one or more models
- Breach of the finding resolutions requirements, i.e. missing the resolution due date without taking prompt corrective actions
- Breach of the model monitoring requirements, i.e. failure to carry out model monitoring plan
- Delay in critical model validation

The exception approval process contained in this Policy aligns with the requirements described in BOCNY's Policy on Risk Policies. Exceptions to this Policy must be justified in writing, be presented to and require the approval of ORC. The decision to grant a policy exception should be documented along with a discussion of the business reasons for the exception.

Documentation of requests and approvals for exceptions to Risk Policies must include, at a minimum:

- The nature of the exception requested
- The individual or group that is requesting the exception
- Model risk exposure (in frequency and amount when applicable)
- The time period during which the exception is effective
- The business reasons for granting the exception
- Mitigating factors
- Planned remediation and closure of the exception, if an effective period is provided

Responsibility for tracking policy exceptions is the responsibility of the business unit requesting the exception. Exceptions to this Policy will then be aggregated by Enterprise Risk Management, and levels and trends of exceptions will be reported to the RMICC on a quarterly basis.

## 2.5. Model Risk Reporting

Model risk may be measured at both **individual** model and **aggregate** levels. As such, both the source and the magnitude of model risk shall be identified, measured, and monitored, and reported on a regular basis.

At individual model level, both the model performance and the quality and promptness of finding remediation actions should be measured and reported. At aggregate level, indicators showing both the magnitude and trend of the model risk in BOCNY shall be identified and reported. The MRM function also developed RAS-KRIs which will be reported to ORC and RMICC.

The MRM reporting items are summarized here (refer to MRM procedure for details):

- Up-to-date model inventory information
- Model risk management policy and procedure updates
- Ongoing model monitoring breaches
- Model validation plan and progress
- Model validation accomplishments
- Model validation findings and remediation status
- KRIs including:
  - Number of models in production without any model risk control in place (RAS KRI)
  - Number of models in use with exceptions (Non-RAS KRI)
  - Number of models in use without ongoing performance monitoring (Non-RAS KRI)
  - Number of past due high risk model validation findings (Non-RAS KRI)

The second line of defense is responsible for such reporting and limit setting, while the third line of defense is charged with the responsibility of testing the effectiveness of such process.

## 3. Model Inventory Management

### 3.1. Model Inventory

A bank-wide model inventory is established and maintained by Enterprise Risk Management MRM function. This inventory should include all models that currently meet or have historically met the definition of a model as per the MRM policies and procedures. The model inventory covers models in various lifecycle stages but not limited to proposed, in development, in implementation, pending validation, in production, and retired. A robust model inventory system enables transparent management reporting framework and prioritization of model validations tasks in accordance with the standards outlined in SR11-7.

At least annually, the model inventory shall be analyzed to assess completeness and determine if changes to the population of models or their attendant status is appropriate. As a key mechanism and common industry practice, model attestation from Department Head of each department shall be implemented at BOCNY. Such attestation shall happen at least annually, and more frequent is deemed necessary by MRM function.

Before being used in production, all new models or “model changes” need to be approved or conditionally approved by ERM-MRM. The criteria for identifying a “model change” is provided under *section 4.2* in the *MRM procedures document*. In case required by business priorities and urgencies, exception permission can be granted for temporary model use before the completion of model validation. Model risk controls and monitoring mechanisms must be set up by model owner during the exception permission period. These risk controls / monitors may include but not limited to – model inputs, system /operational and model output valid for the exception duration.

- **For Tier 1** new models or according “model change”, exception permission must be requested by the model owner and **approved by RMICC**
- **For Tier 2 and Tier 3** new models or according “model change”, exception permission must be requested by the model owner and **approved by ORC**

The exception permission period varies by model tier:

- Tier 1 models could be used no longer than **6 months** under exception permission
- Tier 2 and Tier 3 models could be used no longer than **12 months** under exception permission

Models used under exception permission have to be formally validated and approved by MRM for continuing use beyond the exception permission period.

In the occasion that a model is to be retired from production, the rationale of retirement and evidence demonstrating all the model users, and all other downstream model owners and users have been notified and have agreed to stop using the model need to be provided to ERM-MRM prior and upon ORC approval. Additionally, the relevant new replacement model(s) (if any) need to go through model validation approval process before the original model retirement.

### 3.2. Model Attestation

On an annual basis, the model inventory from each department within BOCNY shall be examined for its accuracy and completeness. MRM will review and discuss the status of the models in the inventory with the respective Department Heads. The process of such review is referred to as “Attestation” which is commonly viewed as an effective approach to ensure the accuracy and completeness of model inventory by confirming the model inventory information with key model risk stakeholders. During this process, each department within BOCNY has the responsibility to fully disclose any potential models they own or use in

their business. MRM will fully assess every model candidate and provide final model inventory list for ORC's approval.

Besides the Model Attestation, MRM function also participates the new product approval process on ongoing basis to ensure any potential new models involved in new product could be assessed timely by MRM function.

### 3.3. Model Tiering

A common practice in model risk management is model risk tiering, which is a qualitative approach in assessing the inherent risk of a model. Model risk tier can be used to prioritize model validation and model ongoing monitoring.

Model risk tier must reflect the **materiality** of the model, which is usually measured based on exposure and impact of the model, either quantitatively or qualitatively, varies by different model types.

Model risk tier is also expected to reflect the **business reliance**, meaning regulatory, and compliance, financial and legal risks the model is exposed to. Such qualitative factors are indicative of the inherent risk the model carries but usually not captured by the materiality measures.

Model risk tier shall also reflect the model **complexity** and input uncertainty.

MRM function has defined three Risk Tiers: **Tier 1** (High Risk), **Tier 2** (Moderate Risk), and **Tier 3** (Low Risk). The risk tier is proposed by Model Owner and approved by MRM function by taking into account the factors discussed above. The final model tier is determined by the combination of first two factors as illustrated in Table 2 with adjustment considering model complexity. The model risk tiering approach and related processes is documented in the Model Risk Management procedure and reviewed on a regular basis as part of the annual MRM procedure review process.

**Table 2: Final Model Tiering**

Inherent Model Risk Level		Model Materiality		
		High	Medium	Low
Business Reliance	High	Tier 1	Tier 1	Tier 2
	Medium	Tier 1	Tier 2	Tier 3
	Low	Tier 2	Tier 3	Tier 3

### 3.4. Annual Model Review and Planning

As a key model risk management process, **model review** shall be carried out on annual basis. The annual model review happens in the beginning of each year based on model inventory attestation results achieved in the prior year. With the scope of the whole inventory the annual model review focuses on, but not limited to following items which happened in previous year:

- Review and assess any model changes

- Review and assess any model tiering changes
- Review and assess model ongoing monitoring results
- Review and assess model validation findings remediation results

Given the results of annual model review, MRM function will perform an **annual validation planning** based on calendar year. As long as a revalidation is completed in the same calendar year as it is planned, compliance to the revalidation requirement is considered met. Model validation shall be prioritized with considerations of model risk tier and model validation type, the revalidation frequency is shown in [section 5.1](#).

The annual validation plan needs to be approved by the ORC at the beginning of the year. The progress according to the plan will be reported to ORC periodically; in case any changes or delays on the plan, the MRM function will make sure the rationale is fully communicated to the ORC and achieve agreement.

## 4. Model Development, Implementation, Monitoring and Use

Model development and implementation represents the first point where model risk can be introduced into an organization due to the pervasive and long-lasting impact that design and implementation decisions can have. These risks are present in the development and implementation of both new models and existing ones. To actively manage model risk within BOCNY, model development and implementation activities must be governed by defined procedures.

The model development and implementation procedures will be reviewed at least annually as part of the annual model review process, or on an ad hoc basis at the request of the MRM function as conditions and circumstances warrant.

### 4.1. Model Development and Implementation

An effective model development process shall be implemented to ensure that the entry point of model risk is well controlled. Commensurate with the model risk tier, the Model Developer and Implementer shall typically follow the following requirement in the practice of model development and implementation.

**Model Developer** must follow formal, structured, and rigorous processes to ensure that internally developed models, as well as acquired vendor models, are appropriate for their intended use, conceptually sound, and are well tested prior to their official use. The **Model Owner** will ensure the up-to-date comprehensive and detailed development documentation is created for each model consistent with the model submission standards in [Appendix B](#).

**Model Implementer** must follow formal, structured, and rigorous processes to ensure that production implementations of internally developed models, as well as acquired vendor models, are computationally accurate and, if applicable, consistent with the development specifications. The term “implementation” refers to the process of encoding the approved model specification into production systems, and is not equivalent to final deployment of the model for production use. Such deployment can only occur after the model has gone through independent model validation and approval process. The **Model Owners** will ensure the implementation information is well documented in compliance with the model submission standards in [Appendix B](#).



The roles and responsibilities involved in development and implementation procedure are summarized in the following Table:

**Table 3: Responsibilities for Relevant Stakeholders**

Key Process	Relevant Stakeholder		
	Model Owner	Model Developer	Model Implementer
<b>Model Development</b>	<ul style="list-style-type: none"> <li>Model Owner has the ultimate responsibility to ensure the model development/implementation information is well recorded and documented in line with BOCNY Model Submission Standards.</li> <li>Model Owner also has the ultimate responsibility to support Model Validator's validation practice along the validation process.</li> </ul>	<ul style="list-style-type: none"> <li>Design robust and stable models using a structured approach, sound techniques, industry-accepted methodologies and extensive testing.</li> <li>Support Model Owner to well document all key decisions about modeling approach, data, structure, assumptions, weaknesses, limitations, development/estimations, and testing results.</li> <li>In the course of model validation, support Model Owner to provide supportive information to the Model Validator in a timely manner.</li> </ul>	
<b>Model Implementation</b>			<ul style="list-style-type: none"> <li>Perform rigorous testing of model production applications to ensure their computational accuracy and consistency with the documented development specifications. This responsibility may be carried out by the IT production system owner, if applicable.</li> <li>Support Model Owner to ensure the details of production implementation, implementation testing, operating procedure, operational controls and ongoing system use are well documented.</li> </ul>

## 4.2. Model Monitoring, Use and Control

Model monitoring is a critical process to ensure the model is performing as expected and model use is appropriate. It provides an opportunity to test whether a model is functioning effectively, used correctly and to assess its performance over time as conditions and model applications change. Due to the constant changing nature of the business environment a model functions within, the model monitoring shall be ongoing.

Once a model is deployed, it is essential to verify that said model is performing as expected or if market circumstances or practices have evolved to the point where a replacement model or methodology should be considered. Moreover, some models have known limitations that are specifically identified during the model development, implementation and validation. It is important to monitor the use of the model in practice in order to ensure all constraints are understood and any agreed upon thresholds are being honored.

Although as a general rule all models must be put under a monitoring framework, the effort and level of rigor that a model monitoring framework imposes shall be commensurate with the risk a model may post. For example, a model that has no current exposure may not need to be tested for performance until its exposure increases; another example is that if a model receives updated input data once a year, the performance monitoring could not be more frequent than once a year.

**Model Owner** and **Model User** shall work closely to provide valuable business insight and monitoring report during all stages of a model's lifecycle. **Model Owner** has ultimate responsibilities to coordinate with model users setting up the model ongoing monitoring and control framework, conduct periodic testing and monitoring of the models to ensure the performance as designed continuously. Any identified model issues will be reported to MRM according to model monitoring and escalation framework defined in Model Risk Management Procedure.

**Model User** is expected to gain good understanding of the model, including its methodology and limitations. They shall understand that all models by definition are imperfect representations of reality and model results are estimates. Knowing the model limitations and using the model conservatively are prudent. Meanwhile the model limitations need to be incorporated in the monitoring process.

**Model User** are usually in charge of the responsibilities of ensuring the integrity and relevance of inputs and assumptions, as well as exercise control over the model use including access control the system, data, and outputs. Model User Manuals shall be developed and delivered to the Model Users. Model User is expected to demonstrate good understanding of both model's approach and its business application. Given the imperfect nature of models, model outputs could be overridden by **Model User**. Such adjustments may mask model performance issues and underlying model weakness. As such, all overrides should be reported as part of the model monitoring process.

Any changes related to the whole model life cycle need to be notified by **Model Owner** and reported to MRM function. A change-based validation by MRM function will be triggered if necessary before the changes are deployed. In any conditions, any changes need to be recorded in the change log maintained by MRM function.

"Model Change Request" needs to be submitted to ERM-MRM with the key information provided in the "Model Change Template". Upon receiving the request, ERM-MRM needs to perform an assessment to decide whether the model change needs to trigger a "target scope validation", or could be taken care in other model risk related activities such as model revalidation or finding closure review. The detailed assessment procedure is described in *section 4.2 of the Model Risk Management Procedure*. If due to urgent business or regulatory requirements, a change approval cannot be obtained within the required timeframe, then the exception permission process defined in MRM procedures needs to be followed before the "Model Changes" is used in production.

The roles and responsibilities involved in ongoing monitoring, model use and control process are summarized in the following Table:

**Table 4: Responsibilities for Relevant Stakeholders**

Key Process	Relevant Stakeholders			
	Model Owner	Model User(s)	All MRM Stakeholders	MRM Function
<b>Model Use</b>	<ul style="list-style-type: none"> <li>Fully understand the model's usage within the Bank. Ensure the business purpose and model use are fully documented in the model submission package</li> </ul>	<ul style="list-style-type: none"> <li>Gain good understanding of the model, including its methodology and limitations to ensure the business usage is appropriate</li> <li>Notify the Model Owner before the usage of the an existing model</li> </ul>		<ul style="list-style-type: none"> <li>MRM functions validates the appropriateness of model usage during model validation process</li> </ul>
<b>Ongoing Monitoring</b>	<ul style="list-style-type: none"> <li>Lead the design of model ongoing monitoring framework and ensure the framework is well documented in model submission package</li> <li>Escalate the breaches to MRM function according to monitoring escalation framework defined in Model Risk Management Procedure</li> </ul>	<ul style="list-style-type: none"> <li>Assist the Model Owner with the design and execution of ongoing monitoring activities</li> </ul>		<ul style="list-style-type: none"> <li>MRM function reviews the robustness of the ongoing monitoring framework during model validation process</li> <li>MRM function reviews and advises actions on any model ongoing monitoring breaches</li> <li>MRM function reviews ongoing monitoring results during annual model review process</li> </ul>

<b>Change Management</b>	<ul style="list-style-type: none"><li>• Report model changes prior to formal business use to MRM function which will decide whether a Change-Based Validation is needed or not</li><li>• Record model changes appropriately no matter the validation is needed or not</li></ul>		<ul style="list-style-type: none"><li>• All the stakeholders have responsibilities to report any relevant changes which happen in whole model life cycle.</li></ul>	<ul style="list-style-type: none"><li>• MRM function records all the relevant model changes in model change log</li></ul>
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## 5. Model Validation

As a key component of Model Risk Management function, all the models regardless of model risk tiering must be subject to an independent model validation. Newly developed models must be independently validated before the deployment within the Branch. It is a violation of this policy to use a model in an official capacity that has not been validated and approved according to MRM framework.

The **independency** of the model validator is a critical condition MRM function needs to ensure. To ensure the independence –

- The model validation needs to be done by people who are not responsible for development or use and do not have a stake in whether a model is determined to be valid to avoid any conflict interest.

The model validators should have relevant **qualifications** to perform model validation. If any third party involved, the evaluation of the third party's capacity will be documented by MRM function.

Overall, during the model validation process, model validator provide “**Effective Challenge**” from following perspectives (refer to MRM Procedure for details)

- Model Documentation
- Business Purpose and Model Use
- Model Input
- Conceptual Soundness
- Outcome Analysis
- Assumptions and Limitations
- Model Implementation and Operational Controls
- Model ongoing Monitoring and Governance

For each full scope validation, MRM function will issue a validation report following the standardized format in [Appendix C](#).

To be compliant with regulatory requirements, the above items must be minimum scope of each model validation. However the rigor of the validation could be different and consistent with the Model Risk Tiering.

## 5.1. Types of Validation

MRM function designs a two-dimensional model validation categorization system, namely:

- Model Validation Scope type: target-scope or full-scope;
- Model Validation Schedule type: baseline validation, change-based validation, re-validation;

Tables below provide more details of the model validation categories:

**Table 5: Model Validation Categories by Scope**

Model Validation Scope	Description
<b>Full Scope Validation</b>	<ul style="list-style-type: none"> <li>• This type of model validation is the most common model validation type and covers all components listed in section 5, and detailed in Model Risk Management Procedure.</li> <li>• A full model validation report is produced at the end which includes all testing procedures, results, analysis, conclusions and findings.</li> </ul>
<b>Target Scope Validation</b>	<p>A target-scope validation is usually due to 1) lack of full documentation due to the time or resource constraint, however with an urgent business need; or 2) the validation is a Change-Based validation.</p> <ul style="list-style-type: none"> <li>• <b>In Scenario 1),</b> the validation usually does not cover all the validation items mentioned in section 5. The minimum validation tasks focus on: <ul style="list-style-type: none"> <li>▪ Business purpose and model use</li> <li>▪ Conceptual soundness</li> <li>▪ Model outcome analysis</li> <li>▪ Model implementation</li> </ul> <p>So the target-scope validation will need Model Owner at least provide above information for MRM function's validation. All other missing items will be issued as part of the conditions of the model approval decision if applicable. The target scope validation can only result in "conditional approval" or "rejection", with conditions, findings issued.</p> </li> <li>• <b>In Scenario 2),</b> the validation will focus on the "model change" and relevant components, and the approval decision could be "approval", "conditional approval" or "rejection".</li> </ul>

**Table 6: Model Validation Categories by Validation Trigger**

Model Validation Trigger	Description
<b>Baseline Validation</b>	<ul style="list-style-type: none"> <li>• The first time a model is validated at full scope is designated as a baseline validation. Baseline validation can be applied to both newly developed and existing models which are already in production.</li> </ul>

<b>Change Based Validation</b>	<ul style="list-style-type: none"> <li>If a model is sufficiently changed to the point that a validation needs to be carried out, the validation is categorized as a change-based validation. Depending on the timeline of the validation, type, scope, impact of the model change, and the availability of the model documentation, this type of validation can be either full-scoped or target-scoped.</li> </ul>								
<b>Re-validation</b>	<ul style="list-style-type: none"> <li>After a model has been baseline validated, the model will be revalidated periodically. The frequency of which shall align with the model risk tier and take into consideration of the model risk that the Bank is exposed to, resource constraints, and industry practice.</li> <li>Taking above considerations, the revalidation frequencies are subject to periodic review as part of the MRM policy review process, in which all factors discussed above, will be assessed to determine if adjustments are warranted.</li> </ul> <table border="1"> <thead> <tr> <th>Tier</th><th>Revalidation Frequency</th></tr> </thead> <tbody> <tr> <td><b>Tier 1</b></td><td>Every 1 year</td></tr> <tr> <td><b>Tier 2</b></td><td>Every 2 years</td></tr> <tr> <td><b>Tier 3</b></td><td>Every 3 years</td></tr> </tbody> </table>	Tier	Revalidation Frequency	<b>Tier 1</b>	Every 1 year	<b>Tier 2</b>	Every 2 years	<b>Tier 3</b>	Every 3 years
Tier	Revalidation Frequency								
<b>Tier 1</b>	Every 1 year								
<b>Tier 2</b>	Every 2 years								
<b>Tier 3</b>	Every 3 years								

Table below shows possible combinations between the two model validation dimensions:

**Table 7: Combination of Model Validation Categories**

		Model Validation Scope	
		Target-Scope	Full-Scoped
<b>Model Validation Trigger</b>	Baseline Validation	✓	✓
	Change Based Validation	✓	✓
	Re-validation	✓	✓

## 5.2. Validation Approval

There are three types of model approval decisions as explained in the Table below. The MRM function performs model validation and reports the results to ORC.

**Table 8: Model Validation Approval Types**

Model Validation Scope	Description
<b>Approval (Fit for Intended Use)</b>	<ul style="list-style-type: none"> <li>The model is deemed fit for the intended use as stated in the model validation report. The model can be used until next model re-validation which results in different outcome.</li> </ul>

<b>Conditional Approval (Fit for Intended Use with Conditions)</b>	<ul style="list-style-type: none"> <li>The model is deemed fit for the intended use as stated in the model validation report, conditioning upon the satisfactory remediation of conditions before the mandatory target date. The conditional approval shall not carry a target date of more than one year away from the decision date, unless otherwise explicitly raised as model risk exception by Model Owner and approved by the ORC.</li> </ul>
<b>Rejection (Not Fit for Intended Use)</b>	<ul style="list-style-type: none"> <li>The model is deemed not fit for the intended use as stated in the model validation report. If the model is in production when it receives a rejection decision, cares shall be taken to ensure business continuity.</li> </ul>

### 5.3. Finding Management

Commonly identified through the model validation processes, findings and associated recommendations (MRM function suggestions on finding remediation) related to specific models are responsibilities of the Model Owners, who must –

- Promptly acknowledge the findings and associated recommendations;
- Provide timely and specific resolution or remediate action plans, with clearly identified assignment and reasonable target dates set for each;
- Carry out the action plans on or before the target dates and provide results and data to MRM function for review.
- Raise issues and obtain approval for target date extensions from MRM function.

Findings and associated recommendations are classified into eight risk categories consistent with validation focuses described in Model Risk Management Procedure, and three risk levels.

**Table 9: Validation Finding Categories**

Finding Category	Description
Documentation	The model submission package (refer to <a href="#">Appendix B</a> ) is incomplete
Business Purpose and Model Use	Business profile is missing or not up to date, the model use is not clear or accurate
Model Input	Model inputs are not clearly documented, missing description on data governance which ensure the data quality
Conceptual Soundness	The model has deficiencies within the model theory and specifications
Model Limitations and Assumption	The model limitations/assumptions are not fully identified or justified; the impacts are not fully analyzed
Reasonableness of Model Output	The model output testing are not sufficient or the testing are not supportive enough to the model theory
Implementation and Operational Control	Missing evidence on implementation accuracy and no strong operational control in place
Model Governance and Ongoing Monitoring	Model ongoing monitoring plan/framework is incomplete or insufficient

**Table 10: Validation Finding Risk Levels**



Risk Level	Risk Level Description
<b>High</b>	<p>A high risk finding signifies a weakness in the soundness of model, which has the potential to compromise the correctness of model outputs, or may prevent a model from being used for its stated purpose. Some examples include:</p> <ul style="list-style-type: none"> <li>• Material data quality issues impacting the model accuracy</li> <li>• Ill-considered model classification, portfolio segmentation or inappropriate model use</li> <li>• Incorrect assumptions leading to unacceptable inaccuracy</li> <li>• Inaccurate modeling methodology</li> <li>• Material errors in model implementation</li> <li>• Ineffective or absent model governance and ongoing monitoring</li> </ul> <p>An action plan must be developed by the model owner immediately to address the issue along with specific timeline.</p>
<b>Medium</b>	<p>A medium risk finding identifies a need to enhance the model on certain aspects. It does not materially impact model correctness or output, but implies flaws which corrected could improve the overall model performance, accuracy, results or implementation.</p> <ul style="list-style-type: none"> <li>• Inadequate justification of modeling methodology and results</li> <li>• Flaws in model implementation which have no direct impact on the fitness of model use</li> <li>• Insufficient controls on key processes</li> </ul> <p>The medium risk finding will not raise a direct concern on model soundness or applicability, but the gaps should be addressed within a reasonable timeframe.</p>
<b>Low</b>	<p>A low risk finding is related to the minor model fixes (e.g. light improvement on model documentation). Usually it could be addressed as part of the business as usual process.</p>

Model owner shall address all findings in a timely manner; however, priority shall be given to high risk findings. Taking into consideration the practice adopted by regulators, internal audit, and business environment of Enterprise Risk Management MRM function adopted the following finding resolution timelines are specified in Table below. Note that they are guidelines and actual resolution timelines assigned can be either shorter or longer based on the specific circumstances related to the findings and the model. If a resolution timeline decision deviates from the guideline, such decision and reasoning behind it must be documented.

**Table 11: Validation Finding Remediation Target Timelines**

Finding Risk Level	Target Resolution Timeline
<b>High</b>	6 Months
<b>Medium</b>	9 Months
<b>Low</b>	12 Months

## **5.4. Dispute and Escalation**

Disagreement on the model approval decision and/or findings may arise from time to time. Although in many circumstances the disagreement can be resolved without escalation, there are cases where they cannot, therefore necessitate an escalation process to ORC or further to RMICC if needed.

## 6. Vendor and Head Office Models

### 6.1. Vendor Models

There is inherited complexity in validation of models developed by vendors which is widely used in BOCNY, which includes the facts that the development data is usually not accessible and the source code for the model is usually not provided. However for vendor models, the same MRM standards as in-house models will be applied as this Policy has stated, in addition, the following items will need to be emphasized:

- Model owner should require the vendor to provide both developmental documentations and ongoing performance monitoring results to facilitate the understanding of the model, meanwhile submit the model follow submission standards except modeling data.
- MRM function will still follow general validation standards and following points are emphasized:
  - The use and customization of vendor model in BOCNY business is appropriate
  - Fully understand the model assumptions to decide whether that's acceptable in BOCNY situation
  - Perform independent testing even without modeling data (benchmark testing, sensitivity testing)

### 6.2. Head Office Models

BOCNY is using certain Head Office (HO) models to support local business. According to US regulator's expectation, all the models used in US business are within the scope of local MRM, therefore the same requirements in MRM framework will be applied to HO models. Given the special nature of HO models, MRM function will emphasize following items for HO models:

- Even the model is owned and developed by HO, a local model owner needs to be assigned to be responsible for the entire model lifecycle in US, and submit the model in compliance with local MRM function requirements. Local model owner and MRM function will make joint effort to request existing model documentations and any necessary information from HO.
- To avoid duplicate effort, the existing testing from HO could be leveraged by local owner or MRM function, however model owner needs to justify the suitability of the model use in local business and set up the ongoing monitoring framework to monitor the model performance on local portfolio. MRM function will also pay attention to above points during model validation.

## **7. Policy Assurance Methods**

### **7.1. Related Procedures**

- Model Risk Management Procedure

### **7.2. Awareness Methods**

The Policy will be distributed to key stakeholders via email on an annual basis with key changes summarized. Each recipient will attest to his or her understanding of the Policy using an email response, which will be documented by the Policy Owner and maintained by the Policy Office. The Policy will also be available in our Policy Library.

### **7.3. Training Methods**

The US CRO is responsible for establishing an environment where model risk professionals have sufficient training and technical expertise. US Enterprise Risk Management will provide training on these policies and their application annually or as the Head of US Enterprise Risk Management determines is necessary to promote full understanding of the Policy.

### **7.4. Policy Adherence Monitoring**

Each applicable department head is responsible for monitoring and assessing the compliance of its procedures with this Policy. This Policy provides for the regular reporting of risk metrics, as outlined in the Risk Governance Framework. Internal Audit will also perform periodic reviewing of compliance through its annual testing process.

### **7.5. Update Requirements**

Along with the requirement for an annual/periodic update, US Enterprise Risk Management is responsible for taking a proactive role in ensuring this Policy remains relevant and comprehensive. It is therefore the responsibility of ERM to monitor internal and external circumstances to determine if and when a policy update may be required in accordance with BOCNY's Policy on Policies and Procedures.

The Policy is reviewed and approved at least annually, or when changes are necessary. Additionally, the Policy is to ensure that it remains applicable to BOCNY's strategy and current and planned activities, and complies with current regulatory requirements. Ad-hoc Policy reviews can be performed at the discretion of US Enterprise Risk Management. US Enterprise Risk Management, ORC, or RMICC may also initiate updates to the Policy in response to changing conditions.

### **7.6. Consequences of Violating the Policy**

In the event that US Enterprise Risk Management uncovers significant violations to the model risk management program requirements, (e.g. Model Owner not notifying Model Validator of a new model deployment or a significant model change), US Enterprise Risk Management will report the violations as appropriate to either the relevant member of the senior management team or RMICC.

Failure to comply with this Policy will be escalated to the US CRO and in certain circumstances to the USRMC, which will consider appropriate remedial action. Violations of the Policy are grounds for disciplinary action, adapted to the circumstances of the particular violation and having as a primary objective furtherance of BOCNY's interest in preventing violations and making clear that violations are neither tolerated nor condoned.

## 7.7. Exceptions & Exemptions

The exception approval process contained in this Policy aligns with the requirements described in BOCNY's Policy on Risk Policies. Exceptions to this Policy must be justified in writing, be presented to US Enterprise Risk Management (or his/her delegate), and will require the approval of ORC. The decision to grant a policy exception should be documented along with a discussion of the business reasons for the exception.

Documentation of requests and approvals for exceptions to Risk Policies must include, at a minimum:

- The nature of the exception requested;
- The individual or group that is requesting the exception;
- Incremental risk exposure (in frequency and amount when applicable);
- The time period during which the exception is effective;
- The business reasons for granting the exception;
- Mitigating factors;
- Planned remediation and closure of the exception, if an effective period is provided.

Responsibility for tracking policy exceptions is the responsibility of the business unit requesting the exception. Exceptions to Risk Policies will then be aggregated by US Enterprise Risk Management, and levels and trends of exceptions will be reported to the RMICC on a quarterly basis.

## 8. Reference Information

### 8.1. External Governance

Below is a list of the applicable guidelines. Please note that this list is not designed to be exhaustive or comprehensive.

- Office of the Comptroller of the Currency, *Large Bank Supervision: Comptroller's Handbook*, (Jan. 2010, Updated Dec. 2015)
- OCC Bulletin 2011-12/ Federal Reserve Bulletin SR 11-7, "Supervisory Guidance on Model Risk Management," April 4, 2011

### 8.2. Other Related Branch Policies, Procedures, and/or Guidance

Refer to Sections 1.3 Related Policies and 7.1 Related Procedures for the related BOCNY documents.

### 8.3. Frequently Asked Questions

Any questions on this Policy should be referred to US Enterprise Risk Management.

### 8.4. Glossary

**Table 12: Glossary**

Abbreviation	Name
<b>BOCNY</b>	Bank of China USA (New York Branch and its satellite branches)
<b>CBD</b>	Corporate Banking Department

<b>CDO</b>	Chief Data Officer
<b>CRO</b>	Chief Risk Officer
<b>ERM</b>	Enterprise Risk Management
<b>FLU</b>	Front Line Units
<b>FMD</b>	Financial Management Department
<b>IAD</b>	Internal Audit Department
<b>IRM</b>	Independent Risk Management
<b>LCD</b>	Legal and Compliance Department
<b>MOD</b>	Middle Office Department
<b>ORC</b>	Operational Risk Committee
<b>ORD</b>	Operational Risk Management Department
<b>RGF</b>	Risk Governance Framework
<b>RMD</b>	Risk Management Department
<b>RMICC</b>	Risk Management and Internal Control Committee
<b>TRD</b>	Treasury Department
<b>TSD</b>	Trade Services Department

# Appendix

## A. Model vs Non-Model Questionnaire

To provide guidance for MRM stakeholders to understand model vs non-model, a questionnaire is designed to inform the decision making and thought process. The questionnaire is listed in Table 13: the “Yes” for question “1” ensures the tool has official usage in the Bank’s activities, the “Yes” for question “2” ensures the tool involves certain level calculation or logics and the “Yes” for question “3” essentially makes the distinguish between “tool” and “model” – compare with “tool”, “model” is based on business or quantitative assumptions, therefore includes uncertainties. So when all three answers are “Yes”, we could firmly decide that the “tool” can be classified as a “model”, however the exceptional cases could happen, and final decision will be made by MRM function.

**Table 13: Questionnaire for Model or Non-Model**

No.	Question	Answer
1	Does the tool have one or multiple usages from following list: <ul style="list-style-type: none"> <li>Analyzing business strategies</li> <li>Informing business decisions</li> <li>Identifying and measuring risk</li> <li>Valuing exposures, instruments or positions</li> <li>Conducting stress testing</li> <li>Assessing adequacy of the capital<sup>1</sup></li> <li>Managing client assets</li> <li>Measuring compliance with internal limits</li> <li>Maintaining the formal control apparatus of the bank</li> <li>Meeting financial or regulatory reporting requirements and issuing public disclosures</li> </ul>	“Yes” or “No”
2	Does the tool involve any statistical, economic, financial, mathematical theories or computational technics?	“Yes” or “No”
3	Does the tool involve any business, quantitative assumptions or uncertainties?	“Yes” or “No”

## B. Model Submission Package Requirements

Model submission documentation submitted before validation should include following components:

**Table 14: Model Submission Documentation Standards/Requirements**

Sections	Requirements
Executive Summary	<ul style="list-style-type: none"> <li>Business background and model use</li> <li>Model Tiering propose and rationale</li> </ul>
Business Background	<ul style="list-style-type: none"> <li>Business impact and materiality of the model</li> <li>Model purpose and model use</li> </ul>
Development Data	<ul style="list-style-type: none"> <li>Model input should be suitable for the model and consistent with the model theory</li> <li>A comprehensive data governance around modeling data that includes: data ownership, data quality, data relevance, data integrity</li> </ul>

<sup>1</sup> Currently there is no capital requirements for BOCNY

Model Methodology and Development	<ul style="list-style-type: none"> <li>• The model methodology, mathematical specifications, and numerical approximations if any, along with business justifications</li> <li>• Model assumptions and limitations with justifications and impact analysis</li> <li>• Details and justifications for any judgmental or qualitative adjustments</li> <li>• Discussion of alternative methodologies and approaches</li> </ul>
Model Output Analysis	<ul style="list-style-type: none"> <li>• Model outputs need to be fully analyzed and tested to support the model purpose</li> <li>• The testing could include sensitivity testing, benchmark testing etc. depending on the type of model</li> </ul>
Implementation	<ul style="list-style-type: none"> <li>• Description of the implementation process, different system components and their interactions</li> <li>• Evidence of the accuracy of implementation</li> <li>• Areas where model will perform poorly if any</li> </ul>
Operational Control	<ul style="list-style-type: none"> <li>• Overall operational control description including: access control, model recovery if applicable, version control</li> <li>• Model use procedures</li> <li>• Model change management process</li> </ul>
Governance and Monitoring	<ul style="list-style-type: none"> <li>• Model governance description</li> <li>• The ongoing monitoring framework with testing, thresholds, frequency, and escalation process</li> </ul>

The physical data package used in model development and testing also need to be submitted upon MRM validation requests.

### ***C. Standardized Model Validation Report Format***

**Table 15: Model Validation Report Standards**

Model Validation Report Sessions	Description of Key Issues Validation Procedures Should Address
Executive Summary	<ul style="list-style-type: none"> <li>• High level summary on introduction of the model and model purpose, business use and impact, model choice, model theory, model input/out, testing, implementation, validation conclusion and key findings</li> </ul>
Model Documentation	<ul style="list-style-type: none"> <li>• Assessment of the adequacy of initial documentation in support of the requested validation</li> </ul>
Business Purpose and Model Use	<ul style="list-style-type: none"> <li>• Assessment of the business impact and appropriateness of model use including considering the upstream and downstream models</li> </ul>
Model Conceptual Soundness	<ul style="list-style-type: none"> <li>• Industry Acceptance - the degree to which the methodology employed align with commonly accepted industry practices</li> <li>• Commonality - the degree to which the methods employed are used in other models within BOCNY</li> <li>• Assumptions - ensure all the model assumptions are documented with appropriate rationale</li> </ul>



	<ul style="list-style-type: none"> <li>• Accuracy of the methodology - review the appropriateness of the model methodology/specifications, and the rationale of approximations</li> <li>• Alternative Approach - provide alternative approach if necessary</li> </ul>
Model Limitations and Assumptions	<ul style="list-style-type: none"> <li>• Assessment of the adequacy of model limitations and assumptions, the impact of model limitations and assumptions, ensuring modeler has done enough testing and analysis to prove the immateriality of impact of limitations and assumptions</li> <li>• Ensure the limitations and assumptions and their impact towards the model are monitored appropriately</li> </ul>
Model Development Data Input	<ul style="list-style-type: none"> <li>• Assessment on the evidence of data accuracy, data quality and data reconciliation</li> </ul>
Reasonableness of Model Output	<ul style="list-style-type: none"> <li>• Perform independent testing to ensure the reasonableness of the model output, the types of testing are depending on model natures</li> </ul>
Model Implementation and Operational Controls	<ul style="list-style-type: none"> <li>• Review on the implementation process and evidence shows the implementation is conducted as intended</li> <li>• Make sure the operational control process is in place to ensure every model component is running and connected appropriately</li> </ul>
Model Governance and Ongoing Monitoring	<ul style="list-style-type: none"> <li>• The ongoing model monitoring framework needs to be set up to test the model accuracy and stability through the corresponding testing with reasonable thresholds</li> <li>• The strong model governance, controls need to be set up among all the model components, the escalation process needs to be defined</li> </ul>
Conclusion	<ul style="list-style-type: none"> <li>• Findings and recommendations - Approval, Conditional Approval (provide specific conditions), or Rejection (provide reasons and alternative approach)</li> </ul>
Appendix	<ul style="list-style-type: none"> <li>• Any related supporting document, chart, data mentioned in above report, need to be attached in this session</li> </ul>