



Advisory

Title	Use of Internal Models for Determining Required Capital for Segregated Fund Risks (LICAT)
Category	Capital Adequacy Requirements
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Sector	Life Insurance and Fraternal Companies

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Purpose:

This instruction guide provides direction to federally regulated life insurers (institutions) that wish to use internal models for determining required capital for segregated fund risks. This instruction guide applies to all segregated fund products that are subject to the provisions of Chapter 7 of the [Life Insurance Capital Adequacy Test \(LICAT\)](#) guideline. Separate approvals will be required for in-Canada and out-of-Canada segregated fund products. Additional criteria may be applicable for out-of-Canada segregated fund products in jurisdictions other than Canada and that wish to use their internal models for determining required capital with respect to this business should consult with OSFI for further information on these requirements.

In order to recognize expected advances in insurance risk management and modelling, this instruction guide will likely be revised from time to time.

Background:

Capital factors were introduced for Canadian segregated fund guarantee risks in 2000. For United States products subject to the provisions of Chapter 7 of the LICAT guideline, institutions developed factors and submitted them to OSFI for approval. This instruction guide outlines the minimum requirements for the use of internal models for calculating required capital in respect of Canadian products that are subject to Chapter 7 requirements.

Internal models for capital purposes are appropriate only when the risk management processes of an institution are adequate. Risk management is the primary defence in protecting an institution against losses; capital must be available in case losses occur. Formula requirements tend to be conservative, as they are intended to apply to a wide range of products. Since internal models are normally expected to produce a more customized capital requirement, the conservatism of the formula would no longer be present. This results in greater reliance being placed on the quality of the risk management. Therefore, risk management is given priority in the discussion that follows.

Institutions wishing to use their internal models to determine required capital must obtain written approval from OSFI. Institutions should make a written application to OSFI's Actuarial Division with a copy to their OSFI Lead Supervisor. The model approval process can be lengthy; therefore, institutions should apply well in advance of the proposed effective date for using their models. Any approval will be conditional on continued compliance with the requirements of this guideline, as modified from time to time.

Transition rules apply to all approvals. For the initial year that approval is given, 50 per cent of the capital requirements, as determined through the use of internal models, and 50 per cent of the capital requirements, as determined by standard or pre-approved LICAT factors, will apply. At the following year end, 100 per cent of internal model requirements will be allowed.

For an institution to be considered for internal model approval, the required capital or business related to segregated funds should be material. OSFI may, from time to time, adjust its materiality threshold. Institutions that wish to obtain approval should discuss their particular circumstances with OSFI's Actuarial Division.

The application must address all the requirements set out in sections 1 to 9 below. A description of all pertinent products should be included.

Supporting documentation and audit trails must be available at the institution for subsequent OSFI review.

Many of the requirements noted in sections 1 to 9 relate specifically to risk management systems for segregated fund exposures and to the use of internal models for measuring such risks. However, many of the requirements also apply more generally to the overall management of risks. The requirements listed below are intended to highlight areas that will be of greatest importance to OSFI when it is assessing an application to use internal models for calculating required capital.

The application should document, by section, how the institution is complying with the criteria, with specific emphasis on the management of segregated fund exposures and the use of internal models in the measurement of such risks. The application should include, as appropriate, information on the frequency of audits and model reviews, documentation and sample reporting.

If OSFI grants an institution approval to use an internal model for determining segregated fund capital requirements as defined in this instruction guide, that specific model must be used to determine required capital for all relevant products. Any significant modifications to the model will require OSFI review and concurrence. See Section 10 for further details.

Institutions that are uncertain as to the applicability of the approved model to a particular product or products should obtain clarification from OSFI's Actuarial Division.

Applications for initial approval of a model, or for any modifications requiring approval, are subject to OSFI's user pay program.

REQUIREMENTS:

Section 1: Role of Senior Management

Senior management is responsible for ensuring the establishment of a risk management framework such that:

1. a risk management culture exists within the organization;
2. the risk management function is comprehensive and global in scope, with underlying risks being incorporated into the overall risk management systems of the organization;
3. written policies and procedures are in place to deal with identifying, measuring, testing, allocating and monitoring all pertinent risks;
4. there are specific policies and procedures in place to address the design, pricing and management of new or emerging risks;
5. risk and procedural benchmarks reflecting industry best practices are in place and reviewed regularly;
6. within the organization there exists independence and a clear separation of responsibilities between those who are responsible for risk monitoring and those who have a significant sales or business focus;
7. lines of responsibility and authority are formally detailed and clearly understood;

8. codes of conduct are clearly defined and in place;
9. the qualifications of all people associated directly or indirectly with the risk management function are regularly assessed and reviewed to ensure that the skills of staff are current;
10. the necessary management information systems and technology are in place and are commensurate with the activities being handled, and that contingency plans exist; and
11. there is a timely risk reporting process satisfying the needs of senior management.

Please refer to OSFI's *Corporate Governance Guideline* for OSFI's expectations of institution Boards of Directors in regards to the management of capital and liquidity.

Section 2: Risk Management Infrastructure

1. The measurement of risk, its allocation, monitoring and control, should rest within a structure that is independent of the business function. Internal Audit is the most prominent example of such a function.
2. The organizational structure of the institution and its relevant committees should indicate a direct flow of risk management responsibilities from the Board to the senior management and risk management functions.
3. The level of skill and experience of key unit staff should be commensurate with the complexity of the risks they monitor. Skills should include systems, finance, business and actuarial. The Appointed Actuary should be an integral element of the risk management process. Individuals involved in the risk management process should not have conflicting responsibilities or conflicting priorities.
4. Risk reporting and related analysis of output from the risk measurement models should contain the necessary information to assess the level and direction of exposures being assumed, and allow for the assessment and evaluation of the extent to which the business risks are within approved operational and capital limits.

5. Reports should be produced that satisfy the needs of each level of risk monitoring and limit control accountability, and should be available to and understood by both the business function and the independent risk management function. Reports, at a minimum, should address risk exposures and action plans, compliance with applicable policies, and audits.
6. The reliability of the data underpinning the reports must be validated.
7. Both short- and long-term contingency plans should be in place to address the potential inability to operate the models. The plans should include a tested procedure for disaster recovery.
8. Qualified systems support should be available on short notice to deal with technical failures.

Section 3: Corporate and Operational Limits

1. Senior management should ensure that aggregate exposure limits exist within the Risk Appetite Framework 1 .
2. Senior management must ensure that the limit allocation architecture and reporting systems are such that the institution is capable of ensuring that aggregate exposure does not exceed established limits.
3. There must be a formalized process by which proposed risk metrics are reviewed and, as appropriate, integrated into the risk management system and process.
4. The allocation of limits and their relationship to the risk management model should be clearly documented and well understood by each business unit to which the limits apply.

Section 4: Model Integration

The models used for determining required capital should be closely integrated into the pricing and valuation processes of the institution. Accordingly, the output from these models should be an integral part of the process of planning, monitoring and controlling the institution's risk profile.

Section 5: Stress Testing (including, but not limited to, FCT analysis)

1. Stress testing scenarios should incorporate single and multiple events, both quantitative and qualitative.
2. Rigorous stress tests must regularly be applied to supplement the output of the risk model. Although the frequency of the tests rests with the institution, monthly analysis is strongly recommended.
3. The results of stress testing must be reviewed regularly by senior management, and should be considered when establishing policies and limits.
4. Stress testing scenarios should capture all material market and insurance risks to which the institution is exposed with respect to segregated fund products, including policyholder behaviour and market liquidity. Sufficiently adverse events must be captured within these scenarios. As an example, a significant market downturn with little or no recovery for a number of years should be tested. Stress tests should provide information about the effect of tail events beyond the confidence level assumed in the calculation of required capital.
5. For scenarios that exhibit vulnerabilities, a discussion of appropriate management actions is warranted. Such strategies should focus on risk reduction and capital preservation. If possible, the strategies should also be modelled to quantify their effects.

Section 6: Documented Policies

1. Written responsibilities and accountabilities for each position in the risk management system should be in place and clearly understood by the incumbents.
2. Documented policies, controls and procedures integral to the risk management process or function must be in place. Examples include valuation, stochastic modelling, validation and sign-off.
3. A routine must be in place for ensuring compliance with risk management policies, controls and procedures.

4. The risk measurement system must be well documented, for example, in a manual that describes the basic principles of the risk management system and provides an explanation of the quantitative techniques used to measure risk.

Section 7: Internal Audit

1. The entire risk management process, including the use of models, must be effectively implemented. Assurance of this should be provided by a body that is independent of every business function within the organization, thereby establishing it as an arm of the Board. Typically, such assurance would be provided by internal audit, although alternative approaches may be acceptable.
2. Internal audit should have in place an effective and reasonable mandate outlining its key responsibilities.
3. Internal audit must be staffed with knowledgeable, experienced and technically qualified people.
4. Internal audit must have formal objectives for each area for which it has audit responsibilities and should review the overall risk management process at regular intervals (ideally not less than once a year). It must document its findings with respect to the following issues, at a minimum:
 1. the adequacy of the documentation of the risk management system and process;
 2. the organization of the risk control unit;
 3. the integration of market risk measures into daily risk management;
 4. the approval process for risk pricing and valuation models;
 5. the validation of any significant change in the risk management process;
 6. the scope of market risks captured by the risk measurement model;
 7. the integrity of the management information system;
 8. the accuracy and completeness of insurance and market data;
 9. the verification of the consistency, timeliness and reliability of data sources used to run internal models; and
 10. the accuracy and appropriateness of volatility and correlation assumptions.

Section 8: Quantitative Model Standards

A. Measurement of Risk

Documentation of the risk measurement system must:

1. provide a detailed outline of the theory, assumptions and mathematical basis for the models used; and
2. elaborate on the techniques used by the institution to meet the more difficult modelling requirements relating to policyholder behaviour and lack of liquidity in financial markets.

B. Compliance

On a regular basis, a compliance program must ensure that:

1. risk management models are used in accordance with documented policies;
2. the responsibility to ensure proper use of the models rests with a senior officer of the institution;
3. risk management models are reviewed by individuals not engaged in the development or regular use of the models for soundness and appropriateness, and the results of such reviews are documented;
4. suitable controls are in place to ensure that model changes are identified, documented and audited;
5. the modelled results used to determine the capital requirements for segregated funds are accurate and reflect the risk characteristics of the business; and
6. there is a process for ongoing analysis of changes in modelled results from one period to the next.

C. Equity Investment Returns and Interest Rates

1. The processes used by the institution for modelling equity investment returns and interest rates must be described in detail.



2. A large number of scenarios should be modelled. The number of scenarios should be appropriate to the models and methodology used (i.e., the number of scenarios chosen should be sufficiently large that modelled results converge at CTE (95)).
3. Care should be taken to ensure that negative interest rates are not generated.
4. Model parameters should be updated regularly to reflect changes in market rates.
5. The validation process must include an analysis of the resulting stochastic investment scenarios to ensure that sufficient market adversity is captured.
6. In the case of hedging or other risk mitigation techniques where risk mitigation is imperfect, procedures should be in place to determine basis risk due to mismatches of:
 - financial instrument features versus underlying asset;
 - term to maturity;
 - specification of payments;
 - credit ratings;
 - unavailability of appropriate instruments.
7. Mapping of funds to proxy classes or indices should be plausible, intuitive and conceptually sound. Documentation, including both theoretical and empirical evidence, must be maintained to demonstrate that the mappings are representative of the risk of the underlying holdings. The relationships of the mapped funds to the proxy funds should be reviewed regularly to validate their appropriateness.

D. Data Integrity and Verification

1. Risk metric data must be subject to regular, rigorous reviews.
2. Responsibilities for the accuracy of insurance and market data should be clearly defined.
3. An audit trail must be maintained for subsequent validation and replication of results.

4. The financial database must be subject to a rigorous verification program to ensure the accuracy of all data.
5. Sign-off on data integrity should be obtained from internal and/or external auditors/consultants.

E. Incorporating Historical Data

1. All current and historical market price data should be derived from reputable and verifiable sources.
2. Parameter estimates for new products or product features should be based on conservative assumptions until sufficient historical data are compiled.
3. Data used should be sufficient to provide reliable and robust cost estimates.
4. The mathematical process for estimating parameters using historical data should be robust.

F. Testing of the Models

1. Models must be subject to rigorous testing, and the results of testing should be adequately documented.
2. Risk management personnel or other appropriate resources should test both the implementation of the models and the theoretical soundness of the models and the assumptions used.
3. Tests should ensure that the model captures all relevant and material risk factors affecting the required capital calculation.
4. Tests should indicate circumstances under which the models do or do not work effectively.
5. Products or features that represent significant risk to the institution should be modelled with particular care.
6. Modelled results should be routinely reviewed and analyzed to ascertain their validity.
7. The validation process must include compliance with the calibration criteria described in the "Report of the CIA Task Force on Segregated Fund Investment Guarantees", dated March 2002. The process should also include reproducing the OSFI-prescribed capital factors for select products in the company's portfolio. It is not necessary to use the assumptions underlying the OSFI factors in the actual modelling.



8. Any modifications of a model or use of a new model must be calibrated in accordance with the above criteria.
9. Models should appropriately reflect correlations among all relevant risk factors. In situations where correlations cannot be reasonably determined, conservative approximations should be used.
10. An audit trail must be maintained for model and assumption modifications, including the rationale supporting the changes.
11. Models should have the flexibility to evaluate the use of financial derivatives within the insurance framework. In other words, the models should allow for the evaluation of risks using both the P-measure and the Q-measure approaches (realistic and risk-neutral).
12. Models must reflect the institution's actual operating practices and product features. For example, if the company is using dynamic hedging, then the modelling of the hedging program should reflect the company's actual practices.
13. Models should be able to evaluate residual risks arising from hedging strategies.
14. The model must be validated periodically against actual market performance. This analysis should demonstrate that actual returns over a reasonably long time frame are within the expected range of the scenarios used in determining required capital.
15. The modelling results must be compared periodically to the capital resulting from applying the LICAT standard approach. The comparison should include an analysis of the key differences. A summary report of the analysis should be provided to executive management. This process should be continued for the transition period.
16. There should be an ongoing analysis of changes in modelled results from one period to the next.
17. The actuary of the company must give an opinion on the appropriateness of the controls, models and assumptions, and the accuracy of the resulting required capital levels. Any differences in the assumptions used for determining required capital versus determining actuarial liabilities should be explained. The actuary's opinion letter must form part of the application.

Section 9: Systems

1. Systems should be developed and maintained in a controlled environment with limited user access.
Additionally, a documented change control process should exist.
2. All data systems must have adequate security and back-up capabilities.
3. Particular attention must be paid to the documentation and consistent use of stochastic scenario sets in the analysis of capital requirements and liabilities.
4. Business recovery plans should be developed, properly documented and tested prior to the use of the models for capital purposes.

Section 10: Modifications to Capital Models

If there are material changes in model usage, assumptions, organizational structure or other such aspects of the risk management process, the company must notify OSFI in writing and explain the rationale for the changes and the resulting implications. Depending on the nature of the changes, a new approval may be required.

Examples of material changes include, but are not limited to:

- a change in model or significant modification to an existing model;
- changes in assumptions that, when used in the model, result in significant differences in capital requirements versus prior assumptions;
- a change in organizational structure that affects the model usage and capital calculation; and
- new products with features or options that significantly differ from the currently modelled portfolio.

Section 11: Capital Requirements

The total gross calculated requirement is determined as the cost calculated at CTE (95) using the approved internal model.

CTE (95) is calculated on two bases:



1. using explicit valuation margins for adverse deviations on the non-scenario tested factors; and
2. without such margins.

The maximum of a. and b. is taken to be CTE (95).

The minimum required capital is the total modelled requirement at CTE (95) for the applicable products, less the net actuarial liabilities, subject to a capital requirement floor of zero.

Section 12: Reporting

Segregated fund risk analyses should be prepared at least monthly and reported to senior management. The institution must monitor the capital requirements continuously. Quarterly reported capital requirements for applicable products must be determined using the OSFI-approved internal model.

Section 13: Additional Capital Requirements

If the institution has deficiencies in satisfying the requirements for the use of internal models of a nature such that substantial improvements are required, the use of internal models for capital determination will be disallowed. However, if the deficiencies are less serious, OSFI may agree to permit the use of such models, but impose additional capital requirements. In this case, the institution must submit a plan that will rapidly achieve full compliance with the requirements for the use of internal models, obtain OSFI approval of the plan, and implement it quickly. The additional capital requirements will be removed once the institution has demonstrated to OSFI's satisfaction that it has successfully resolved the deficiencies.

Section 14: Ongoing Compliance with Requirements

Documentation demonstrating compliance with all sections above must be maintained. All relevant documents should be available for onsite review.

Footnotes

- 1 Refer to OSFI's Corporate Governance Guideline for additional guidance in this area.