



PBA Implementation Guide

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STEPS TO CONSTRUCT A HIGH-LEVEL
IMPLEMENTATION PLAN

SPONSORED BY

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0 Preface: Background

for Actuarial and Non-Actuarial Executives with Leadership Roles in PBA Implementation

Principle-Based Approach (PBA) reserves (often referred to as PBR) and the Valuation Manual for life insurance, including section VM-20, is a paradigm shift in the determination of statutory life insurance reserves with potentially far reaching business implications. For example, VM-20 could impact the way company performance metrics such as earnings are measured and interpreted and hence how companies are managed. PBA encompasses not only reserves but also capital, which is separate, but will follow similar concepts. The implementation effort involved is significant, so it is important to start planning for the transition as early as possible. This Guide outlines benefits and provides a Road Map for doing so.

Differences Between Historical Valuation and PBA

To understand future implications, we should first look at how reserves have been historically valued. A simplified, less than precise view follows. The financial valuation of life reserves has been formula based. For broad categories of products, the formulas did not always keep up with specific risks as products evolved. The formulas used the same assumptions (and margins) for all companies (for example, mortality). The same formula was used and applied to each policy. Formulas and assumptions were determined at issue and did not change. Reserves did not reflect the assets supporting the liabilities, company investment strategy, company experience, policyholder behavior or any future economic scenarios.

Companies have been offering more complex product and benefit features. Companies are using more complex investment strategies, including hedging strategies. As the insurance industry has changed, disconnects developed between reserve formulas and actual product risk profiles. Reserves used static formulas that:

- Are increasingly difficult to apply
- Address only the risks specifically identified in the formula and assumptions
- Consider only liability cash flows and not asset cash flows
- Can disguise risks via conservative assumptions.

As a result, formula rules-based reserves are too high for some products and too low for others. Regulators have been using “band-aid” approaches with limited success.

The goal of PBA and the Valuation Manual is to have reserves that:

- Are more “right-sized” and that properly reflects the financial risks, benefits, and guarantees associated with the policies being valued
- Align policy reserves with product risks and the risk management practices of the company
- Reflect each company’s own experience for risks such as mortality, policyholder behavior, and expenses
- Reflect the impact under a variety of future economic conditions including interest rates, equity returns and asset defaults.

VM-20 reserves can require up to three different calculations based on the risk profile of the products and supporting assets – a formula based Net Premium Reserve and two principle-based reserves – a Stochastic Reserve (SR) based on many scenarios and a Deterministic Reserve (DR) based on single baseline scenario. The principle-based reserves SR and DR (1) are model-based calculations for groups of policies, (2) reflect changes in assumptions over time to reflect changes in company experience, (3) use margins based on the uncertainty of experience and level of tail risks, (4) reflect specific risks in products, and (5) reflect risk management business practices.

Calculating SR and DR incurs resources and costs. A provision in VM-20 called the Exclusion Tests permits companies to determine if the benefits of calculating and reporting SR and DR are worth the cost. The intent is that if the product's sensitivity due to changing economic conditions, policyholder behavior, and other factors is less than a certain threshold then a company may choose to not calculate SR and DR. Resources and costs are incurred to perform the exclusion tests.

PBA better recognizes risks embedded in insurance contracts. Risks embedded in insurance balance sheets run the continuum from low to high based on:

- Product portfolio
- Benefit features and optionality
- Investment portfolio and strategy
- Underwriting process
- Operating processes

PBA is designed to recognize this continuum. PBA helps provide regulators a more accurate reflection of the risks insurers face. Company risk management functions will be more transparent. Capital and reserves will better account for all material risks of the business practice and the products sold by a company. The improved alignment is expected to reduce redundant reserves for some products and increase inadequate reserves for products where significant product risks are not captured by the current reserve valuation methodology

Impact on Functional Areas

The actuarial function will be significantly impacted. Other functional areas will also be impacted. Collaboration will be a critical factor in a successful implementation. PBA places:

- Greater reliance on a company's cash flow models
- Greater need for resources to build, maintain and operate models
- Greater responsibility on the actuary
- Greater demands on technology, computing and data resources to support stochastic models, and an increase in the number of times models are run (for example, sensitivity testing, quantification of margins, changes in assumptions, validations, and analysis) – all within business reporting and planning time constraints and governance and audit standards
- Greater emphasis on company experience and defining margins

- Greater emphasis on governance (experience studies, inputs, models, outputs, processes) and disclosures
- Greater need to secure staff resources and skill sets with the capability to understand, to interpret, and to explain PBA results to technical and non-technical audiences.

Disclosures and Adequate Information for Regulators

Regulators are concerned about getting enough information from the PBA process to be able to: (1) review PBA reserves, and (2) ascertain what changes to the Valuation Manual are needed going forward to ensure the continued “right sizing” of reserves. The Valuation Manual and PBA are more than reporting a numerical value on the statutory balance sheet. The PBA reserves, capital, disclosures, and processes are inseparable. Therefore it is critical that:

- The PBA production process from assumption and margin setting, to exclusion tests, to sensitivity testing, to disclosures, is auditable
- Well-documented governance controls are in place, including assumption oversight and model risk controls
- Experience studies are conducted with appropriate frequency and a structure for sharing results with regulators has been developed.

Business Implications and Resources

PBA is a force of change that will likely impact the competitive landscape, product offerings and development. Investment strategy will have an impact on stochastic and deterministic reserves. The following example illustrates this point in the extreme. A strategy investing 100% of the assets in commercial paper or 100% in 100-year C rated bonds will have much larger reserves than a strategy aligned appropriately with the liabilities. PBA reserves reflect the risk profile of the liabilities *and* assets. See the [Executive Overview](#) for additional implications.

Although the title is, “PBA *Implementation Guide*”, the Guide and your implementation must look beyond getting to Day 1. Resources needed during the implementation will continue to be needed for ongoing management of the PBA process and its changes. Post-implementation PBA activities must effectively support business strategy and operations.

Looking Elsewhere for Lessons Learned

A PBA process is already in place for variable annuities, in the requirements of Actuarial Guideline 43 and the capital requirement in C3 Phase 2. Companies that sell variable annuities may want to look at that process to determine: (1) if they can learn something from it as to what works and what does not work, (2) transfer and leverage investments in capabilities and processes for variables annuities for their life PBA implementation, and (3) reevaluate their variable annuity PBA processes as the life PBA processes are designed and built utilizing the steps and considerations from this Guide. Companies without variable annuities may want to see what can be learned from the implementation and post-implementation experiences of variable annuity writers.

Plan Now

For all the above demands and reasons, forming a company PBA strategy and an implementation plan now will provide tangible benefits and will be invaluable to ensure compliance when the time comes.

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1 Guide Overview

*Underlined words in [Blue](#) are hyperlinks. Clicking will send you elsewhere in the document to tie-in related pictures, narrative, define a word, or provide a more detailed explanation. The shortcut **Alt + Left Arrow** will return you to where you were before hyperlinking.*

While the Valuation Manual VM-20 (this Guide is based on the December 2, 2012, version) describes requirements for principle-based approach (PBA) reserves for life products, the VM does not set forth resources and changes in processes and workflows needed by insurers to implement the VM requirements. This Guide’s purpose is to provide a better understanding of key considerations an insurer will encounter in creating a principle-based framework for determining reserves and risk-based capital and to facilitate implementation and operation of principle-based frameworks. Tangible benefits include reduced resources, time and costs, and more effective frameworks. The Guide steers users through steps to construct a [Road Map](#), which is the Guide’s term for a high-level implementation plan.

The Guide parallels travel guide books designed to help tourists plan a successful trip, such as to Paris or Rome. First you leaf through the travel guide, skimming sections based on your interests in historical sites, cultural and sporting events, restaurants, transportation and

Parallels with a Travel Guide	
Not read cover to cover/skip around	
Interests	:: Requirements
Itineraries	:: Road Maps
Things to Do	:: Projects/Initiatives
Successful trip	:: Implementation

lodging. There are sample itineraries for one-, two-, and three-day visits. Based on your initial scoping you make a list of potential things to see and to do. Second, you then read more carefully and continue to reread as your list narrows, family members bargain, and final choices are made along with priority must do’s and optional and contingency plans. Third, your

actual trip does not follow the plan exactly, and you adapt accordingly. The Implementation Guide can be used in a similar fashion.

This Guide provides high, mid-, and low-level views of issues in implementing VM-20. The Guide does not delve into detailed plans listing subtasks of tasks and schedules to the day, week, or month. It does not quantify potential financial implications. It does not provide possible interpretations of VM-20. It is not a survey ascertaining current and intended PBA frameworks. However, a company should understand financial implications, should explore and evaluate various interpretations, and should consider alternative frameworks.

The Guide includes the travel guide equivalents of sights, events, and sample itineraries. A Road Map indicates a company’s goals, starting points, and ways to achieve the goals. PBA implementation is in essence performing a [gap analysis](#) and bridging the gaps. Determine where you are (current framework), where you want to be (future PBA framework), and why ([requirements](#)), what ([initiatives](#)), how, and when to get there (Road Map). Sounds simple, yet could be overwhelming.

Guide Content

Chapter 2 is a [User Manual](#) outlining steps on how to use this Guide. Chapter 3 provides an [Executive Overview](#) linking VM requirement implications with business requirements and company strategy. Chapter 3 is intended for company management charged with implementation responsibilities and developing company PBA strategy.

Chapter 5 contains six [Case Studies](#) each containing three parts: a company profile, a Road Map, and supporting initiatives. Each Case Study's parts should be read alongside each other as the components are dependent upon each other. For each Case Study, a company profile outlines requirements and considerations for that company and a Road Map outlines the PBA initiatives the company will undertake. Project scale reflects the magnitude and complexity of the implementation and the case studies range from minimalist to enormous. Chapter 6 contains various [flow charts](#) to visually capture VM-20 requirements to aid users in forming a view of their future PBA framework.

Chapter 7 is a [Scoping Guide](#) outlining steps for a precursory gap analysis as the preliminary work to formulate a Road Map. The Scoping Guide includes steps to

- 1 [Identify business requirements and financial reporting requirements](#)
- 2 [Assemble a view of current framework](#)
- 3 [Form a view of future PBA framework](#)
- 4 [Evaluate the current framework versus PBA framework](#)

and concludes with a gap analysis template: a [Self-Assessment Evaluation Report Card](#). Scoping is intended to be a 30,000-foot exercise and preliminary, tentative, and/or skeletal in nature. Scoping's intent is not to find solutions but to identify and get one's arms around key issues. The scoping stage is related to the Delphi Oracle's maxim "know thy self." Scoping activities primarily consist of getting to know thy current self and thy future self.

Chapter 8 is a [Road Map Guide](#) steering users to ask more substantive questions, to explore alternatives, and to evaluate and implement competencies, capabilities, activities, and processes that could collectively be called [practices](#). For each category, a VM requirement overview, implications, and PBA implementation considerations are provided. The Road Map Guide concludes with potential initiatives (i.e., action items) to implement PBA. Chapter 9 contains [lessons shared](#) by the participants and the author's observations. Chapter 10 contains [literature resources](#) for numerous issues pertinent to a PBA framework.

Organizationally [PBA visual flow charts](#) (Chapter 6) and [potential Road Map initiatives](#) (Chapter 8.8) have each been consolidated, although the narrative pertaining to them is interspersed throughout the Guide. With a few of exceptions flow charts are not duplicated where discussed but instead rely on document hyperlinks. To discuss pertinent issues and to describe a PBA framework, implementation activities, and tasks the Guide utilizes the following categories:

- Assumption Setting
- Inputs
- Model Platforms (Throughputs)

- Outputs
- Technology and Systems
- Actuarial Organization

Categories are integrated, and PBA implementation initiatives such as building and validating models will span all categories. However, the Guide assesses VM-20 requirements and deconstructs and presents considerations according to these categories. The Guide is not suggesting PBA issues be treated as silos within these categories—quite the opposite. Some considerations are so intertwined that processes must reflect holistic solutions.

The templates and Case Studies are in the Guide’s companion Excel file to facilitate use, modifications, and importation. By rearranging templates, redefining categories, renaming labels, modifying considerations, reducing and adding detail, and adjusting timelines, resources, and sequencing, the tools and templates are transformed into something useful to the only company that matters—yours.

Where to Start

Habit 2 in Stephen R Covey’s best seller *The 7 Habits of Highly Effective People* is “Begin with the End in Mind.” Covey states, “Begin with the End in Mind means to begin each day, task, or project with a clear vision of your desired direction and destination, and then continue by flexing your proactive muscles to make things happen.”

The steps in the User Manual start with the end in mind. The Executive Overview provides a broad strategic view. Before diving into details the Guide starts at the end destination—Case Study Road Maps. If the end is a Road Map, then let us start by describing what this Guide means by a Road Map.

A Road Map conveys planning information identifying “what,” “how much,” “who,” “when,” and “how.” A Road Map is

- A multiyear integrated set of projects or initiatives and prioritizations
- An articulation of the right steps and resources
- A top-down high-level estimate of projected work efforts, duration timelines, and all-in costs
- A prioritization framework to evaluate alternatives and their cost-benefits and to translate implementation requirements into tangible steps
- A platform to provide focus and to facilitate ongoing analysis of priorities, timelines, and investments

A Road Map’s initial purpose may be in securing management’s approval and a PBA budget.

2 User Manual

We advocate breadth before depth. Get through all the issues to gain a big picture perspective before you attempt to dive deep to understand all the details and iteratively add depth. We advocate the same approach while implementing initiatives.

Steps

- 1 Read the [Executive Overview](#)
 - 1.1 Develop a short list of issues essential to your PBA strategy.
- 2 Review Case Study Road Map(s)
 - 2.1 Read [Case Study Company Profile Snapshots](#). Select one or two Case Studies to read. (We do not recommend reading all six Case Studies upon first reading the Guide.)
 - 2.2 Review the issues and initiatives in the selected Case Study: Profile, Road Map, and Road Map Initiatives. Consider how the Case Study Road Map reflects your requirements and PBA strategy—initiatives, timing, and sequencing.
- 3 Review [Flow Charts](#)
 - 3.1 Use the [Product Decision Tree](#) and [Potential Reserve Applicability](#) to form a preliminary view of the applicability of stochastic, deterministic, and net premium reserves for your current product portfolio.
- 4 Browse [Scoping Guide](#) alongside Case Study Road Maps and Flow Charts
- 5 Browse [Road Map Guide](#) alongside Case Study Road Maps and Flow Charts
- 6 Browse [Participant Comments and Author's Observations](#)
- 7 Select additional references in [Literature Resources](#)
 - 7.1 Use other resources to appropriately explore and analyze pertinent details.
- 8 Revisit any of the above steps and reread Guide sections as needed including additional Case Studies
- 9 Conduct [Scoping Exercise](#)
 - 9.1 Triage and modify the considerations (into critical, pertinent, and not applicable).
 - 9.2 Articulate your PBA strategy.
 - 9.3 Articulate your requirements.
 - 9.4 Determine what is needed and the timing for when it is needed.
 - 9.5 Adapt and complete [Self-Assessment Evaluation Report Card](#).
- 10 Conduct [Road Mapping Exercise](#)
 - 10.1 Triage and modify the considerations.
 - 10.2 Explore and analyze pertinent details .
 - 10.3 Assess implications of business and VM-20 requirements on your PBA framework.
 - 10.4 Select and adapt [Road Map Initiatives](#).
 - 10.5 Select, blend, and adapt the Case Study Road Maps.
- 11 Construct your Road Map
 - 11.1 Construct the essentials and milestones—capture your PBA strategy.
 - 11.2 Revisit and reread any of the above steps as needed.
 - 11.3 Align Road Map with your PBA and company's strategy.
 - 11.4 Fill in pertinent detail.
- 12 Implement and periodically update Road Map

3 Executive Overview

The Guide outlines steps or exercises to perform a gap analysis and to develop a Road Map on bridging the gaps. The author's goal is that the Guide be *useful*—a roll-up-your-sleeves kind of usefulness. The Guide does not purport to provide a Road Map that will actually be *used* by a

A Road Map points the way from your current framework to your PBA framework reflecting requirements including company strategy.

company or to be something pretty to display on your office wall. For a Road Map to be used “as is” by even a single company would preclude its usefulness to other companies. The Guide provides tools, templates, skeleton structures, scoping, and mapping exercises that a company can apply, adapt, and fill in appropriate details. The Guide provides verbal summaries and visual flow chart overviews of various VM-20 and PBA components and requirements, six Case Study Road Maps, and [initiatives](#) (or action items) to bridge the gaps and implement PBA. During the Guide's development these templates and exercises were vetted with more than 15 participants selected from a diverse group of companies.

The Guide contains [six Case Study Road Maps](#) ranging in magnitude and scope. They range from a minimalist implementation calling for 360 work days and a budget under \$50,000 to a large implementation calling for 2,700 work days of effort and a budget over \$1 million. The intent is that readers select one using the [Case Study Company Profile Snapshots](#) to use as a frame of reference as opposed to reading all six. The Case Studies are illustrative of translating vast quantities of detailed requirements into Road Maps. There is no shortage of details in VM-20. Your Road Map and implementation must successfully navigate the details. To avoid being mired and overwhelmed in detail the Guide takes a top-down approach.

3.1 Executive Guidance

There are no conclusions to summarize per se. Instead of a typical Summary the Executive Overview provides an underlying rationale for the steps outlined in the Guide to support an executive's formation of overall PBA strategy. The Guide contains a vast number of considerations. Asking the right questions is a critical factor in a successful implementation. It takes a few seconds to discard a consideration as being not applicable to your company. Developing the right considerations is time consuming. Overlooking a consideration costs time, resources, and dollars. The Guide does not presume to be exhaustive or contain all considerations a company should make. However, reviewing considerations in the Guide will make it easier for users to think of the right questions or recast existing considerations.

Three frequently asked questions are:

“Where should we start?”

“What are others doing?” and

“What do we need to do and what don't we need to do?”

First, start with a plan. “No, what we meant was ‘where should the plan start?’” That is the purpose of this Guide. Second, companies are concerned they might not realize or appreciate the relative importance of something, they might misallocate resources of time and money, and they might do too little or too much of something, especially if it did not pertain to them. They also want lessons learned on what works or what does not work. These lessons will continue to emerge over time. Third, the safe answer “that depends” is often a means to avoid confronting the issues. In this case “that depends” is the issue. “Where to start” questions should not be fully answered until other questions are asked and many considerations to navigate through the considerations are pondered.



Construct Your Road Map Now

We cannot overemphasize the advantages of planning and of planning now. The benefits of doing so and the downsides of not doing so are numerous. Constructing your Road Map now does not necessarily mean the Map is frontloaded with large expenditures of time, effort, and money. Among the benefits, doing this:

- Offers companies the greatest degrees of freedom to bridge gaps
- Allows gaps to be divided into manageable substeps that can be achieved with reasonable resources over time
- Diminishes the impact of dependencies
- Provides time to figure things out
- Reduces chances of wasted efforts and expenditures.

Numerous companies are concerned with having enough resources or the cost of procuring additional resources to implement and operate in a PBA paradigm. Spreading out the implementation work allows management more choices. Constructing a Map now permits some of the transition from the current framework to the future PBA framework to occur incrementally in manageable sub-steps and to be coordinated with other actuarial or company projects as a marginal increase in resources.

Waiting until the last year or two will place great demands on staff and resources, increase the impact of dependencies, heighten urgency as everything becomes critical with little time to figure things out, increase the amount of implementation work that exceeds internal staff's capacity increasing reliance on external resources, and increase execution risks.

Implementation Project Magnitude

Project magnitude and complexity are related to several dimensions, including business strategy, usage in [decision-making](#), products and features, business requirements (e.g., financial close schedule), staff size, management philosophy (conservative/aggressive), policy count, existing framework, recent and ongoing activities, organizational structure, and asset/company size. Significant factors impacting project scope and which VM requirements are applicable will be product features and risk profiles. See [6.1, Product Decision Tree](#), and [6.2, Potential Reserve Applicability](#) to assist with these determinations.

Perhaps the most significant factor affecting project scope is the degree to which statutory financial intelligence is incorporated into business decision making. The Guide makes a sharp distinction between the usage of the words *information* and [intelligence](#). For example, the PBA financial statement reserve is information, and the explanations of PBA earning variances are intelligence.

The Guide employs five stages of decision-making intelligence: acquisition, delivery, acceptance, interpretation, and implementation—culminating in performance. For some companies statutory financials are highly relied upon by management in all five stages including risk management by contributing to frameworks for identifying, measuring, monitoring, reporting, and managing risks. For some companies statutory financials are a *de minimis* factor in management decisions. Statutory results need to be delivered and accepted by certain stakeholders such as regulators and auditors, but other accounting measures such as GAAP and Economic Capital form the basis of decision making. See [7.3.1, Identify Business and Financial Reporting Requirements](#), for fuller development.

Two significant factors affecting project magnitude are the product portfolio and the extent to which a company uses statutory metrics in decision-making intelligence.

A value chain is a related set of activities and support functions that increase the usefulness (value) of the products or services of a firm (value-added activities). Implementing and operating PBA is one activity in the value chain. Operating

ORSA (Own Risk and Solvency Assessment) and risk management are similar activities. The degree of resources invested in activities should reflect the degree to which they support business strategy and drive value creation. Information is costly, intelligence more so. The magnitude and complexity in implementing PBA reflects if, why, and how decision makers accept, interpret, and implement PBA intelligence.

Companies managed on a U.S. GAAP rather than statutory accounting basis may soon find the need for PBA frameworks supporting management decision making in all five stages if potential PBA changes in GAAP come to fruition. Although there are significant differences between GAAP proposals and VM-20, the foundational capabilities underlying each have much in common.

Gap Analysis and Road Map: Breadth before Depth. Top Down.

Conducting a gap analysis requires forming a view of the desired future PBA framework. Constructing a Road Map to bridge the gaps can be paralyzing. VM-20 contains a vast amount of detail. Understanding how the details are interrelated, their implications, and how to discern or learn which details are critical can result in a quagmire. We recommend breadth before depth in constructing the Road Map. First, rapidly gain a big picture perspective. Then add in depth of detail and knowledge to construct the Map. Form a skeleton or frame of a Map and fill in details in an iterative fashion. A top-down approach facilitates focusing on the essentials. Optional things and additional functionality can be added once the essentials are in place.

One and Many

Many frameworks and processes exist to meet current [requirements](#). PBA will push these processes and frameworks to their limits due to a significant increase in volume, such as more scenarios, more sensitivities, and more model runs to quantify assumptions and margins. A simple question to ask is, if your cash flow testing had to meet the same timeline as current statutory reporting and other demands such as governance, audits, accuracy, granularity, and explanations to management—what would break? What if cash flow testing were run dozens of times? What would it take to make it work? The current framework may be sufficient if a process is run *one* time but insufficient in a PBA framework if the process will be run *many* times. Thus it is important to not only ask *can* it be done but *how*. The *how* can be measured in terms of cost and resources.

Leverage Existing Competencies

Several research reports by the Society of Actuaries indicate PBA models will likely be derived from existing financial reporting or cash flow testing models. However, a PBA framework is more than a model and spans processes, culture, and business strategy. A company will want to leverage competencies from both financial reporting and cash flow testing functions.

Financial reporting and cash flow testing functions often reside in different departments and utilize different modeling platforms, processes, and personnel. Each serves different needs, and each has different strengths. Stochastic analysis, assumption setting and dynamic formulas, and nonpremium/benefit cash flows including assets have historically been the domain of cash flow testing. However, cash flow testing may have been in nonproduction environments under moderate time constraints with pass/fail outcomes using models with approximate and conservative methods and assumptions. Financial reporting exists in Sarbanes-Oxley or Model Audit Rule environments with standards and rigors of being precise, auditable, timely, and insightful. Reporting receives the attention of management, auditors, and analysts regarding earnings, explanations, planning, decision making, and constant comparisons of forecasts to actual results. However, reporting may lack the infrastructure and capabilities required to gather experience data, set assumptions, and model and explain stochastic results.

Foundational Improvements

An implementation focused on minimizing work effort and cost might implement only what is absolutely necessary to comply. A cost-reduced implementation is highly dependent on VM

details. However, details will likely change rendering the new framework ineffective or costly to maintain and to operate. A narrow implementation will not necessarily support other business needs. A lesson from Solvency II delays and requirement changes is that narrow implementations are more costly and provide fewer benefits.

Foundational improvements are initiatives and projects addressing the *how* and increasing capacity, whether it is the frequency of changing assumptions, running models, supporting validation, or analyzing the volume of output. Foundational improvements are not VM-20 specific but do consider VM requirements. Foundational improvements support multiple business needs from risk management, other reporting bases, and economic capital to transitioning from the current framework to the future PBA framework. Forming a plan now allows PBA to be integrated into ongoing and future foundational improvements. Foundational improvements have benefits beyond today and tomorrow's regulatory requirements and increase current operational efficiencies, thereby increasing available resources to implement subsequent phases of PBA.

Requirements

We revisit the question, "What do we need to do?" and the answer, "That depends." It depends on your [requirements](#). It depends on what is needed to support your business strategy. Requirements can be framed in several dimensions. The industry will have a vast spectrum of VM-20 and business requirements differing in kind and degree. Requirements will factor into decisions such as [Day-1 versus Day-2 versus Day-3](#) PBA deliverables, the degree of capabilities, and the priority, sequencing, and pace of implementation activities. Important factors underlying business requirements include the relative importance of statutory earnings versus U.S. Generally Accepted Accounting Principles (GAAP) or International Financial Reporting Standards (IFRS), the financial close schedule, the application and use of financial and modeling intelligence, and required accuracy and granularity. Factors underlying your VM-20 requirements include products and features.

Form requirements twice,
implement once

The Road Map Guide provides a narrative overview of VM-20 requirements, and flow charts provide a visual overview (including reserve applicability and a product decision tree). What you need to do will be significantly impacted by whether or not stochastic reserves or deterministic reserves are calculated. The adage "Measure twice, cut once" can be recast as "Form requirements twice, implement once." See [7.3.1, Identify Business and Financial Reporting Requirements](#).

VM has data submission, documentation, and governance requirements specified in VM-31, VM-50, VM-51, and VM-G. Work efforts to comply with these requirements will be considerable and should be coordinated with Model Audit Rule and ORSA requirements. VM-G is not intended to create new duties for the Appointed Actuary, senior management, or the board of directors but rather emphasize and clarify their roles and responsibilities. See [Governance](#).

The Right PBA Framework, PBA Practices, and Road Map

The subsection title is a misnomer. *The* right PBA framework, practices, or Map is not identified nor sought. There is not *one* that is superior from all perspectives. There are numerous trade-offs that must be taken into consideration in regard to a company's strategy and core competencies. What is the right PBA framework for one company could be wrong for another and vice versa. There are not, a priori, best or leading practices that universally should be utilized by *all* companies. The right framework, practices, and Road Map for each company align with and support a company's strategy.

The words *Map* and *Plan* are both nouns and verbs. As nouns they mean "a representation" and "an outline or sketch of doing, making or constructing a work." As verbs they mean "to prepare sketches or to plan for a work to be executed or built." Planning and mapping as verbs, that is, as processes, are pursuits that shed insights into trade-offs, alignment, and fit. Performing the process involves asking important questions along the way. Processes, alignment, and fit are unique to each company. As nouns, for the industry there are many right frameworks, practices, and maps. The scoping and mapping exercises (verb) have as much or more value than the map (noun).

Practices Follow Requirements

The [Road Map Guide Introduction](#) explores practices in a PBA future framework in four areas:

- 1 Capability: Can and How
- 2 Automation
- 3 Centralization
- 4 Robust versus Flexible

Key decisions throughout the implementation will reflect choices in these four interrelated areas critical to operating a PBA framework. Addressing gaps and deficiencies will be integral components of any Road Map. The considerations are to what extent, when, and how a company should implement capabilities, full automation, a centralized input database, model, or output database, and fully or partially flexible and robust infrastructures. Two questions are: Is more always better? and Is most/all always best? Our opinion is *sometimes* and *no*.

[Practices](#) should be aligned with company strategy. For example, five business-level strategies are cost leadership, differentiation, focused cost leadership, focused differentiation, and integrated cost leadership/differentiation. Each strategy will have different requirements. The right capabilities, activities, and processes including actuarial practices are not identical across all strategies. The competencies and leading practices to support a cost leadership and differentiation strategies have similarities but have important distinctions.

One thing that is certain in a PBA world is change. Assumptions will be updated and changed. Models will be built, maintained, and changed. New events will occur, and output and analysis will be changed to understand relationships and explain results. VM-20 is itself a moving target that will undergo change. Flexibility will allow companies to respond and evolve with change.

Think Anew

Implementing PBA provides an opportunity to reevaluate activities and processes supporting current business needs. VM-20 is not the only PBA development. The Financial Accounting Standards Board (FASB) and the International Accounting Standards Board (IASB) have been evaluating and developing PBA accounting standards. Risk management measures such as economic capital utilize PBA and regulatory capital and solvency requirements will incorporate ORSA (Own Risk and Solvency Assessment).

Companies will think anew in many areas. Abraham Lincoln said, “The dogmas of the quiet past are inadequate to the stormy present. ... As our case is new, so we must think anew, and act anew.” What is adequate in a pass/fail asset adequacy analysis framework may be inadequate in a PBA framework that determines reserves in financial statements. For example, consider granularity along a number of dimensions. Models can be grouped or compressed along many dimensions from product features to policy groupings to assumptions and characteristics to investment strategies to output and profit loss splits to validation analysis. Consider the impact of granularity on accuracy and transparency. In general, the question: Could granularity choices materially change the result, change your view, or change your decision?

The Actuarial Standards Board *Principle-Based Reserves for Life Products Exposure Draft* definition section states, “Granularity—The extent to which a model contains separate components such as cells, or assumptions that vary by cell or time intervals. Models with a higher degree of granularity (more cells or assumption variations) may provide more model precision or flexibility, but may also require greater effort and expense to design, maintain, assemble and run.”

Reasonable. Practical and Workable before Perfection. Figure Things Out.

The word “reasonable” appears 15 times in VM-20, for example, “shall use a reasonable approach,” and appears 16 times in *Principle-Based Reserves for Life Products Exposure Draft*. A PBA framework relies on actuarial judgment. International guidance uses the concept of parsimony. Winston Churchill wrote, “The maxim *nothing avails but perfection* may be spelled shorter—*paralysis*” and his axiom was, “Do not let the better be the enemy of good.” We believe this and the adage of Occam's razor are sound advice to heed in implementing PBA. A PBA framework has many components and processes that will evolve over many years, not many months. Time will be required to figure things out such as VM-20 interpretations, processes, validations, analytics, implications, and relationships. The more a company utilizes statutory-based intelligence in its decision-making process, the more time will be required to figure things out to balance trade-offs and choices throughout the PBA framework.

Resources

Human resources, internal or external, will be a significant factor in a PBA budget. Moody's Analytics *2013 Solvency II Practitioner Survey* found 67% of survey participants had to increase staff to address the Solvency II requirements by at least 10%, of which 13% doubled their staff. Two main factors were cited for the increase in permanent staff: (1) the shortage of resources across functions (risk management, accounting, actuarial, IT) and (2) the lack of

skilled capabilities, particularly actuarial skills. During implementation an alternative to staff increases is utilizing external consultants.

A strategic consideration is the desire that the same people who implement and build the PBA models and PBA framework continue to operate, maintain, and continually improve the framework and models. Much of the implementation will be figuring things out, especially relationships. This intelligence is valuable, costly to attain, and bears directly on business plans, understanding business drivers, and management decisions. The more statutory reporting is used by management, the greater the strategic value of statutory intelligence.

If additional resources are needed during implementation, several participants indicated they would outsource non-PBA ongoing activities such as repricing straightforward products rather than outsource PBA activities. First, to build models, staff expertise in company products and management interactions such as how dividends lag interest rates, crediting rate strategies, and policyholder behavior are hard to pass off to external resources. Second, if PBA reporting is the future for the next decade or more, then the PBA framework and the ability to meet management's needs should be a company and actuarial core competency.

Assumptions

How, when, and what is needed to support PBA assumptions? Your answer significantly impacts your Road Map timeline. We explore the implications of assumption margins on your VM-20 and business requirements. Depending on products VM-20 may require calculating three reserve values—the Net Premium Reserve, Stochastic Reserve (SR), and Deterministic Reserve (DR)—and holding the maximum. There are exclusion tests, which if passed, allow a company to forgo calculating the SR and/or the DR.

Many companies are concerned about their levels of data credibility. Low credibility results in higher margins, which can result in higher reserves. Industry presentations and publications have mentioned supplementing data with industry or reinsurer data as a possible solution. In the Road Map Guide ([8.7, Potential Road Map Initiatives](#)), potential initiative “1.05 Explore and secure supplemental data sources (for mortality, lapses, ...)” is included expressly with this in mind. Several Case Studies include 1.05 as an implementation initiative. Even large companies with more than a million policies are looking to supplement data pertaining to policyholder behavior such as premium persistency and lapsation for ULSG products.

In particular there is concern regarding the mortality assumptions: margins are prescribed based on several factors. Credibility has a significant impact on margins (for example, margins range from 5% to 20% for issue ages 46–47) and the grade-in period, which translates into a significant impact on the level of SR and DR. Since the ratio in the Stochastic Exclusion Ratio Test (SERT) is based on an adjusted DR, SERT is also impacted (see 6.6, [Stochastic Exclusion Ratio Test](#)).

For products that will, with certainty, pass the exclusion tests, the mortality assumption and mortality data credibility become nonissues on the level of reported reserves. The mortality

assumption gets used only to calculate the ratio in the SERT. In fact, since the denominator of the ratio is the present value of benefits, a higher mortality assumption increases the denominator while the numerator changes little (a second order effect), decreasing the SERT ratio.

Asset assumptions are another point of concern. Assumptions are prescribed through the combination of prescribed defaults and spreads.

Many companies' historical and expected net spreads for commercial mortgages are larger than the prescribed assumption (the net spread is capped at 104% of the applicable corresponding historical U.S. Treasury yield rate most closely coinciding with the dates of purchase and maturity structure of supporting assets plus 25 basis points). A smaller spread will increase SR and DR. Again, for products passing exclusion tests, the asset assumption becomes a nonissue on the level of reported reserves.

SR and DR assumptions, margins and data credibility become non-issues on the level of reserves for products passing Exclusion Tests. For failing products these are critical issues.

For products failing an exclusion test, assumptions, margins, and credibility are critical issues. Products with different exclusion test outcomes may therefore have different requirements, timelines, and dependencies regarding valuation, pricing, and business planning due to different needs in knowing and setting assumptions.

Asset Allocation

Asset cash flows and investment returns impact the level of SR and DR. SR and DR are calculated at aggregate levels. Model segments are a group of policies with similar investment strategies to which assets are allocated in the models. For PBA time will be needed to understand the impact of assets assigned to the model segments on DR and SR results. Alternatives include pro rata, newly purchased assets, or benchmarks. VM-20 applies only prospectively to new business. During the initial years of PBA the first two alternatives may not be representative of the small percentage of PBA liabilities in force in a model segment relative to company's management of the entire portfolio. A poor assignment of assets that mismatch the liabilities could result in failing the SERT, whereas a better match results in passing.

Your Move. PBA Strategy.

So far the Overview's focus has been from an internal perspective. The gap analysis assesses internal gaps derived from an internal view of a PBA framework to comply with VM-20 reporting, documentation, and governance requirements and with business requirements to reflect management's use of statutory financial intelligence. Bridging gaps leverages internal core competencies. An internal-only view does not provide a complete perspective necessary to formulate a PBA strategy and decide your moves (i.e., construct your Road Map).

A company may make Road Map choices regarding capabilities or when to sequence PBA implementation activities based on the relative importance of its products using measurements, such as market position, revenue, and earnings, for example, when to be

capable of reporting PBA results, analyzing and explaining PBA results, and developing the business plan on a PBA basis. As a simple example, suppose UL Product A and Term Product B represent 80% and 20% of a company's sales. Preliminary analysis by the company indicates reserves may decrease 15% for Product B under VM-20, but the beneficial financial impact on earnings and capital does not warrant early action. The company in its Road Map decides to implement PBA for A as soon as VM-20 is effective but to take the full transition period for B. For A, the Road Map schedules product pricing and the business plan to fully reflect PBA the year prior to first reporting PBA results.

VM-20 will also manifest external forces of change that your Road Map must consider. Road Map choices regarding capabilities or when to sequence PBA implementation activities must also reflect anticipated competitor actions such as launching new products. Product B may be much more important to one or more of your competitors. Some competitors will implement PBA and reprice their version of Product B in order to launch the new product as soon as VM-20 is effective at lower prices. How and when will you respond? Will you be a first mover? If you wait to build the requisite PBA capabilities once new products are launched, do you have a move? Or have you missed an opportunity or are too late? If so, what is the long-term impact? How will your distribution channel react? These are questions senior management should ponder today.

Products calculating stochastic reserve and deterministic reserves will incur more resources than products passing both exclusion tests. The increased cost may cause some companies to reconsider the attractiveness of certain products, product features, and markets. A shift in economy of scale may result in a competitive shift. Some companies may consider exiting or modifying products rather than be required to meet stochastic reserve requirements.

Which products will be most impacted by PBA? Term and ULSG are expected to be the two products most affected by VM-20, but do not overlook other products. Your Road Map must consider competitor behavior and be constructed to support company strategy accordingly. When will new products be rolled out, and what prerequisites are there and how long will they take?

Internal strategic discussions between management, marketing, operations, and accounting are critical to formulate your PBA strategy. Besides product development another item to incorporate into your PBA strategy is the impact on capital and risk management strategies including actions by both direct writers and reinsurers.

Moving Target

Another frequently asked question is, "Why begin now—VM-20 will be changed and has numerous proposals under discussion such as aggregate versus individual margins and many other proposals." We remain steadfast in our opening

Intend to wait until states pass VM? Construct Road Map 1.0 that captures your PBA strategy but defers some detail. Add details in Road Map 2.0.

should be high level and flexible to have much the same look now and in a few years. The conclusions, sequencing, and details of the implementation activities may change considerably, but your strategy on why and when to adopt, launch products, reflect PBA in business plans, and incorporate VM-20 into managing the business will not. Your Road Map will be comprised of many [foundational improvements](#) to your current work activities that will have immediate benefits with or without VM-20. Other changes such as a delay in VM-20's effective date by one or two years will stretch out your timeline of when you begin, work on, and complete implementation activities, but your strategy should be able to adapt to changes in details.

One Guide, Multiple Plans, Different Outcomes

Will one shoe (Guide) fit all sizes? Companies have a range of different competitive strategies with different business needs, competencies, strengths, and weaknesses. Wide continuums exist along a number of dimensions: small actuarial staffs of five or fewer to large staffs of 50 or more; infrequently launched plain vanilla products to frequently introduced cutting edge and complex products such as shadow account Universal Life secondary guarantee products; statutory-only companies to companies also reporting and/or managing on a GAAP or Market Consistent Embedded Value or Economic Capital bases; companies with factor-based models running Gross Premium Valuations on a single desktop computer to companies with sophisticated models running 1,000 stochastic scenarios on 100 processor grids; and companies performing a NY7 asset adequacy once a year to companies running frequent Asset Liability Management or hedging programs.

Wherever a company may be on the spectrum of today or tomorrow's demands, challenges, resources, and capabilities, there are common elements in implementing and operating a PBA framework. The scoping and road mapping exercises will be fairly similar across a broad range of companies. High-level workflows are also similar. Road Maps will have similar structures. Potential considerations and questions to ask are similar but which considerations are important or even applicable, and the answers to the questions will be unique. Thus, the frameworks, practices and Road Maps will be unique as well.

Translating Road Maps into detailed Implementation work plans will be and should be unique to each company; however, there will be common themes. Initial valuation will be an immediate need. Strategic needs such as forecasting, explaining earnings, planning, revisiting accounting influenced decisions, and developing new PBA-based products will happen simultaneously or even before the effective date. Road Maps will uniquely reflect the what, how, how much, and when these PBA implementation activities occur.

Yes, one Guide fits all sizes, and yes, the Guide will lead companies down divergent paths. By rearranging templates, redefining categories, renaming labels, modifying considerations, reducing and adding detail, adjusting timelines, resources and sequencing, the tools and templates are transformed into something useful to the only company that matters – yours. And like if you were going to Paris or Rome, enjoy a successful trip.



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Guide Development

The various processes in developing this Guide entailed (1) participant selection, (2) numerous rounds of telephone interviews with participants, (3) participant homework assignments, (4) follow-up email correspondence, and (5) a literature scan. The participants represented a diverse cross section of the life industry across numerous dimensions such as asset size, policy counts, organizational structure, products, actuarial staff sizes, reporting bases, importance of statutory accounting in decision making by management, external auditors, and actuarial systems.

The Guide was constructed in several stages or rounds. During Round 1 the authors compiled a list of talking points to learn about participants' current frameworks. In Rounds 2–4 working documents of the Scoping Guide, Road Map Guide, and Case Studies were drafted based on the previous round's interviews and homework assignments. The working documents were updated as we progressed through the interviews in each round. We received invaluable feedback on usefulness, relevance, structure, organization, content, clarity, and many other additional considerations. We received requests such as if you were to include "this" or more of

“that” we would find it most useful. We assigned homework in the form of information requests on current processes and requirements and completing the Self-Assessment Evaluation Report Card. Finally, we assembled the pieces together and the Guide went through numerous revisions based on participant and Project Oversight Group feedback.

Guide Usage

This Guide is intended solely for illustrative and educational purposes. It is not intended to determine any specific situation. The narratives, considerations, and Case Study Road Maps may not be applicable to certain situations. If legal, accounting, or actuarial advice or other expert assistance is required, the services of a competent professional should be sought. The authors, the Project Oversight Group, their employers, or the Society of Actuaries shall not have any responsibility or liability to any person or entity with respect to damages alleged to have been caused directly or indirectly by the content or the use or misuse of this Guide. Although the Guide captures a multitude of inputs and perspectives from many companies, the comments and views expressed may not be representative of the full industry.

5 Case Study Road Maps

Each Case Study contains

- 1) A company profile—an abbreviated synopsis of the company’s business requirements, current framework, and its intentions to reach its future target PBA framework.
- 2) The Road Map (a visual chart)
- 3) Road Map Initiatives consisting of projects and actions the company will undertake identified through its evaluation of the considerations in the Scoping and Road Map Guides.

All six Case Study Road Maps and supporting Initiatives are also contained in the Guide’s companion file, *Implementation Guide Templates.xls*. There are two tabs per Case Study (e.g., named *CS1.Map* and *CS1.Detail*). The tab named *CS.Snapshot* has a summary of the Case Study Profiles. The Case Study User Manual describes how to read the triple combination of Profile/Map/Initiatives.

5.1 Case Study User Manual

We do not recommend reading all six Case Studies. Use the [Case Study Company Profile Snapshots](#) to select one or two Case Studies.

A Road Map conveys planning information identifying “what,” “how much,” “who,” “when,” and “how.” A Road Map is:

- A multiyear integrated set of projects or initiatives and prioritizations
- An articulation of the right steps and resources
- A top-down high-level estimate of projected work efforts, duration timelines, and all-in costs
- A prioritization framework to evaluate alternatives and their cost benefits and to translate implementation requirements into tangible steps
- A platform to provide focus and to facilitate ongoing analysis of priorities, timelines, and investments

There are six Case Studies numbered one through six that increase in magnitude and scope. Each Case Study contains a company profile. Road Map Initiatives consists of initiatives the company will undertake identified through its evaluation of the considerations in the Scoping and Road Map Guides. The company’s evaluation is implicitly contained within the profile and Road Map initiatives.

Except for Case Study 1, initiatives are organized into categories:

- (1) Plan, (2) Assumptions, (3) Inputs, (4) Model, (5) PBA Model,
- (6) Output, (7) Technology, and (8) Governance/Regulatory

Due to being a more simplistic project, Case Study 1 reduces the number of categories and adds subcategories related to PBA calculations.

Format

The Case Study Road Map (e.g., [Case Study 2](#)) provides a high-level visual chart with initiative categories forming the rows and calendar time forming the columns. The numbers within the

chart (e.g., 2.11, 3.2, and 5.4) represent initiatives that are itemized and assigned a subcategory item number in the Road Map Initiatives. For example, [Case Study 2 initiative 2.7](#) (remediate data capture) occurs in the second quarter of 2015. Categories with multiple initiatives occurring in the same quarter have multiple rows.

The Road Map conveys the intensity of implementation effort—the pace and level of resourcing—through colors. **Green** is used to indicate a dedicated and focused effort where one or more staff are entirely or primarily devoted to the initiative for an extended period of time and possibly supplemented by external resources. **Yellow** is used to indicate moderate efforts to implement incremental improvements, refinements, and enhancements. **Yellow** might represent smaller gaps between current and future frameworks, ongoing continuous improvement efforts, or [foundational improvements](#) that incorporate PBA as one of the considerations and the additional work effort impact is marginal. **Gray** is used to indicate no or little work effort; for example, as an initiative is completed future work efforts are included in normal operations or maintenance. The Road Map uses a circled number **○** to convey major milestones representing a significant and critical achievement toward PBA implementation, and uses a diamond **◇** to convey important or intermediate deliverables.

Purpose

The six Case Study Road Maps are not intended for companies to use as is. They are intended to serve as a template that companies will modify and adapt to their circumstances by adding or deleting initiatives and details, moving, rearranging, contracting or extending timelines, changing the work intensity efforts, and borrowing from several Case Studies. One participant said, “A realistic plan requires a realistic assessment,” understanding that the Case Study profiles are not and were not intended to be a full and realistic assessment of the many considerations contained in the scoping and road mapping exercises. It is beyond the Guide’s scope to reflect the nuances of current frameworks and to reflect fully requirements and strategy. The Case Study Road Maps reflect implicit considerations that companies will need to reflect explicitly. Implicit considerations include additional details, recognition of priorities, ease of implementation, current framework and gaps, importance, costs, realized benefits, work effort, resource availability, skill set gaps, conflicts, bottlenecks, dependencies, discontinuous work efforts and business or project continuities, execution risks, coordination with other company projects, or balancing PBA work efforts with day-to-day activities.

Initiatives are action items and should start with a verb but not necessarily the verb used. One company may need to develop or build while another needs to enhance or refine. Exactly what an initiative description means is explicitly defined by the user. “Build and validate term NPR” might mean certain steps for one company and other steps for another. The important factor is that the Road Map, the future target PBA framework, the initiatives, the details, and what “done” means at each phase are clearly articulated to and understood by the PBA team. The Road Map will need to be translated into executable work plans with objectives, activity timelines, and resource assignments. The Road Map and the future PBA framework will evolve during the course of Implementation as circumstances, discoveries, issues, and details emerge.

5.2 Six Case Study Company Profile Snapshots

Assumes no change in the importance of statutory versus GAAP or the frequency of statutory reporting activities due to PBA.

Information	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 6
Measurement and Accountability	Statutory earnings and capital but not in incentive compensation. No GAAP	GAAP earnings in incentive compensation. Statutory Capital	Statutory earnings and capital in incentive compensation. No GAAP	Statutory earnings and capital in incentive compensation. No GAAP	GAAP earnings in incentive compensation Statutory capital. Economic capital	GAAP earnings in incentive compensation Statutory capital. Economic capital
Decision Making: Five Stages	Implementation	Acceptance	Implementation	Implementation	Acceptance	Acceptance
Business Planning	Twice per year	GAAP, eye on RBC Three times per year	Twice per year	Twice per year	Quarterly + Next Year Plan (Nov.)	Quarterly + Next Year Plan (Nov.)
Close Schedule (Statutory/GAAP)	25 business days	15 business days	18 business days	25 business days	18 business days	15 business days
Products Issued	Par Whole Life Level and Non-Level Term	Non-Par Whole Life, Competitive Level, and Non-Level Term UL w/o SG ULSG: specified premium	Par Whole Life, Competitive Level and Non-Level Term UL w/o SG ULSG: specified premium	Par Whole Life, Competitive Level and Non-Level Term UL w/o SG	Non-Par Whole Life, Competitive Level and Non-Level Term, UL w/o SG ULSG: specified premium or one shadow account VUL Index UL	Non-Par Whole Life, Competitive Level and Non-Level Term UL w/o SG, ULSG: specified premium and multiple shadow account structures VUL Index UL Life LTC Combo
Staff Size* Credentialed/ Student/Technical	2/1/1	7/5/3	7/5/3	2/4/1	25/12/5	15/8/3
Organization	One actuarial department	Four departments: Annuity/Life Pricing, Reporting, Corporate, and Risk Management	Four departments: Annuity/Life Pricing, Reporting, Corporate, and Risk Management	One actuarial department	Eight departments	Five departments

Six Case Study Company Profile Snapshots continued

Information	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 6
Policies in Force (000s)	115	700	800	200	2,000	1,400
Polices Issued per Year (000s)	6	40	45	17	100	77
Management Philosophy	Conservative	Medium	Medium	Medium	Semi-Aggressive	Aggressive
No. of Life Entities	1	3	3	2	10+	5
No. of P/L's **	1	2-3	2-3	2	5-10	3-7
Model Systems	No conversion	67% through a conversion	90% through a conversion	Will convert	No conversion	No conversion
Technology	Same	Incremental	Need a grid Data: needs to handle volume	Incremental	Incremental	Incremental
Database	Same	Same	To purchase	Same	Same	Same
Increase to Staff	0	0	One in 2014	0	Four: two in 14, two in 15	Three: One in 14, 15, and 16
VM-20 Expectations	VM-A/C, NPR, SET, DET	VM-A/C, NPR, ET	VM-A/C, NPR, ET	VM-A/C, NPR, DR, SET	VM-A/C, NPR, DR, SR	VM-A/C, NPR, DR, SR, SET
General/Additional	None	FASB PBA GAAP proposals are an additional consideration***	No VAs	None	Simultaneously coordinate with FASB PBA GAAP proposals*** Sell VAGLBs	Simultaneously coordinate with FASB PBA GAAP proposals*** Sell VAGLBs

*For companies with more than one department, staff size counts Life Financial Reporting, Valuation, Business Planning/Forecasting, Modeling, and Cash Flow Testing functions. It excludes functions such as Product Development, Risk Management, Reinsurance, Acquisitions and Annuity, Health, and P&C functions.

**Profit/Loss Statements within entities for nonproduct splits, for example, by Strategic Business Unit, Division, Market, and Distribution Channel.

***For example, the Insurance Contracts Exposure Draft published June 27, 2013.

5.3 Case Study 1

5.3.1 Case Study 1: Profile Requirements and Key Assumptions

Current reporting is on a statutory but not on a GAAP basis. Measurement and accountability are statutory earnings and capital; however, financials are not a component of incentive compensation. Company management is conservative. Life products consist of Participating Traditional Whole Life and Level Term. Both product design and investment strategy are conservative. There are 115,000 policies in force, and about 1,200 Whole Life and 4,800 Term policies are issued each year.

Business planning takes place twice per year. The financial close schedule is 25 business days. There is one legal life entity and one P/L for each product line. There is one actuarial department, and staff consists of two credentialed actuaries, an actuarial student, and one technical support person. Valuation is done using company proprietary programs on the mainframe. Cash flow testing is done using a software release no longer being supported on a server.

Verifying SET is passed is the Road Map's key milestone...

A critical assumption is that both exclusion tests will be passed for Term and Whole Life. The business expectation is that PBA implementation will have a minimal impact to operations, and the goal is to minimize cost. No additions to staff are planned. No technology expenditures specifically

to support PBA are expected (grids, databases, or applications). Other ongoing and future projects will be leveraged to include PBA as a consideration rather than initiatives being formed exclusively for PBA.

Run time for cash flow testing is not an issue. Cash flow testing software will require considerable effort to support the Stochastic Exclusion Ratio Test, an effort the company would like to avoid at best and defer at worst. Products have limited optionality, and previous analysis has shown policyholder behavior does not materially impact cash flow testing results. Current experience studies are in Microsoft Excel and Access, and the infrastructure is considered adequate for PBA assumptions. The content of data is an item to be reviewed, but major gaps are not expected. Credibility is an issue, and means to supplement data through additional sources will be explored. Implications of low credibility are higher SR and DR reserves. If SET and DET are passed, the reserve held will be the NPR not SR or DR. No infrastructure exists to support prescribed methods of developing mortality assumptions, asset defaults, and spreads. SET calculations do not go into Financials. Therefore the need for speed, explanations, and analytics are minimal. The need will be to validate.

...only NPR capabilities would be needed. If SET and DET are passed additional data for credibility will not be pursued.

The Road Map timeline assumes VM will become effective January 1, 2016. The intent is to take the full transition period and implement PBA for Whole Life for December 31, 2019, financials. The intent is to implement PBA for Term for December 31, 2016, to realize expected reductions in reserves but only if both exclusion tests are indeed passed and the cost to implement is less than the benefits.

The Plan assumes SET and DET are passed. The alternatives under consideration for SET are:

- 1) Pursue SET certification method (VM-20 6.A.1.a.iii).
- 2) Initially outsource the preview evaluation and the first demonstration in 2016.
Potentially continue to outsource or bring in-house in 2018–19.

Both these alternatives are believed to be more cost effective solutions than an in-house solution through 2018–19, at which time a long-term solution will be reevaluated. The initial SET will be performed in 2016 and the second in May–June 2019 using March 31, 2019, in force (and then every three years). When implemented, participating Whole Life will pass SET using the certification method (VM-20 6.A.1.a.iii). If the SET Preview in early 2015 fails, then Plan B is to take the full transition period for Term. At that time new Road Map details would be developed.

Road Map detail is through first quarter 2017. Throughout implementation the company will discuss its PBA plans, intentions, and interpretations with their external auditor and state regulator and discuss the regulator expectations. A review by the state regulator is expected in 2017–18. Road Map detail and resource requirements for 2018 and beyond will be developed during mid-2017.

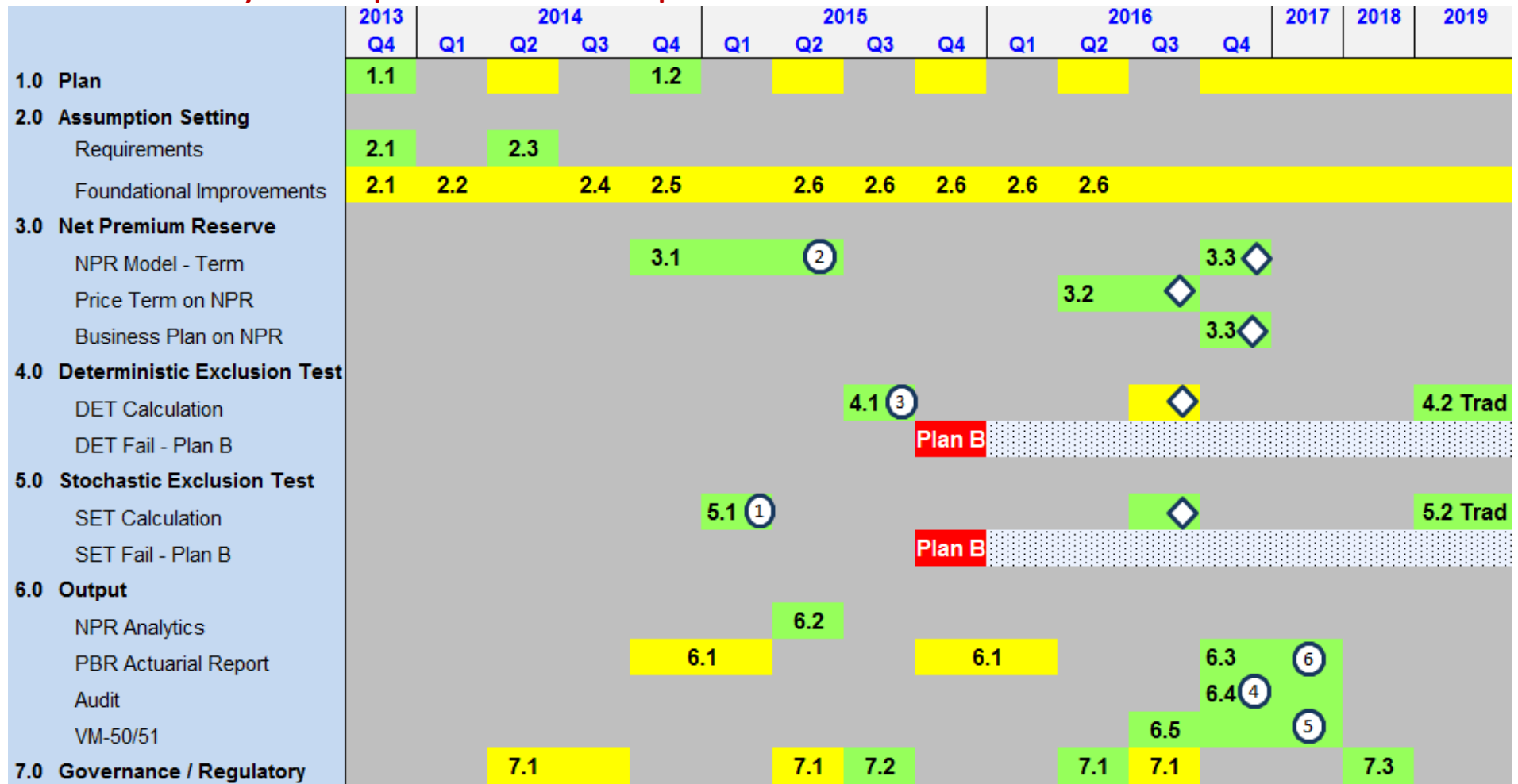
Milestones

- 1 Perform the stochastic exclusion test as first step to verify that only the NPR will need to be calculated for Term and VM-A/C for Whole Life (5.1)
- 2 NPR calculation and analytic capabilities (3.1 and 6.2)
- 3 Performing the deterministic exclusion test to verify that only the NPR will need to be calculated for Term and VM-A/C for Whole Life (4.1)
- 4 Review by internal and external audit
- 5 Submission of VM-50/51 data
- 6 Submission of PBR Actuarial Report

External/Consulting Budget

- 1 Peer Review will be used to review the prescribed SR/DR mortality and asset charge methods and assumptions, the NPR calculations, and the PBR Actuarial Report.
- 2 Perform SET in early 2015 and again in mid-2016
- 3 No hardware or software expenditures

5.3.2 Case Study 1 PBA Implementation Road Map



Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.3.3 Case Study 1 Road Map Initiatives

* Work Effort is measured in days and as the *incremental increase* due to PBA

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	12	
1.2	Secure PBA budget	2	
2.1	Identify disclosure requirement gaps: VM-31, VM-50, and VM-51 Identify assumption data requirement gaps: VM-20 Section 9 Establish procedures to input assumptions into the models and validate done correctly (apply to 2013 Asset Adequacy Analysis)	8 8 6	
2.2	Formalize existing activities Develop and formalize philosophy for setting assumptions and margins Establish policies and procedures pertaining to consistent application of assumptions Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication	36	32
2.3	Remediate data capture and reconciliation gaps Explore supplemental data sources (for mortality, lapses)	8 10	40
2.4	Develop DR/SR mortality assumption calculations and process Develop asset default charge process Peer review	24 10 3	
2.5	Define margin explicitly Document assumption and margin methods Peer review	5 5 3	
2.6	Remediate and/or refine additional issues	0	
3.1	Build and validate NPR calculations	24	36
	Peer review	8	
3.2	Build NPR projection; price product	10	
3.3	Project September 30, 2016, NPR; then 2017 Run post-parallel September 30, 2016	10 10	
4.1	Calculate and validate DET	10	10
4.2	Calculate and validate Whole Life DET	5	
5.1	Calculate and validate SET	5	
5.2	Certify: Whole Life SET—certification	5	
6.1	Modify AOM to be consistent where possible with PAR requirements	22	
6.2	Modify current statutory analytics for NPR	8	
6.3	Construct Report structure; write Report	12	
6.4	Address auditor issues	8	
6.5	Construct, validate, and submit data requirements	12	4
7.1	Discuss PBA with state regulator	4	
7.2	Update Model Audit Rule processes and documentation	10	
7.3	State Regulator PBA Review	8	
TOTAL		311	122

5.4 Case Study 2

A real Road Map would integrate VM-20 implementation with other company initiatives including GAAP proposals. However, this is beyond the scope of this Guide and this Case Study.

5.4.1 Case Study 2: Profile Requirements and Considerations

Current reporting is on a statutory and GAAP basis. Measurement and accountability metrics are GAAP earnings and statutory capital. Growth in GAAP earnings is a driver of incentive compensation. Company management is medium, that is, it is not either the conservative or aggressive ends of the spectrum. Life products consist of nonparticipating Traditional Whole Life, Competitive Level, and non-Level Term and Accumulation UL and UL with specified premium secondary guarantees (ULSG). Other products include flexible and single-premium fixed deferred annuities, immediate annuities, group annuities, and individual accident and health products. Life premium rates are moderately competitive except for Term, which is more competitive. Product features are conservative. The investment strategy is semiaggressive in areas the company feels it has competencies. There are 700,000 policies in force and about 5,000 Whole Life, 10,000 UL, and 25,000 Term policies are issued each year.

Business planning takes place three times per year. The financial close schedule is 15 business days. There are three legal life entities and three P/L's for each product line. There are four actuarial departments: Annuity Product Development, Life Product Development, Financial Reporting, and Corporate and Risk Management. Staff involved in reporting, planning, and cash flow testing consists of seven credentialed actuaries, five actuarial students, and three technical support personnel. The business expectation is that PBA will be implemented without undue stress and will be accommodated at current staffing levels. Implementing and operating PBA will curtail other projects and ongoing activities that are done. PBA expenditures will be absorbed into the overall actuarial budget, specifically its consulting budget.

The Road Map timeline assumes VM will become effective January 1, 2016. The intent is to implement PBA for Term for December 31, 2016, to realize expected reductions in reserves and to take the full transition period and implement PBA for Whole Life and UL for December 31, 2019,

Launching a new PBA Term product is a key business requirement. If Term exclusion tests are passed SR and DR reserves and assumptions are not used in financials ...

financials. PBA is not expected to require significant expenditures. The initial focus of the Road Map is model development. PBA requirements related to assumptions, inputs, outputs, technology, and governance will be incremental in nature with a few things addressed each year rather than a concerted effort. Other ongoing and future projects will be leveraged to include PBA as a consideration rather than initiatives being formed exclusively for PBA.

During the next few years every actuarial department project and company initiative provide an opportunity to include PBA considerations as marginal additions to the project. For each PBA

initiative the initial build will be basic, practical, and functional and not necessarily productionalized or industrialized. Then over subsequent periods it will continue to evolve through incremental improvements at each opportunity.

Consultants will be used for thought leadership and to peer review new key PBA methods or processes, especially assumption setting and reasonableness of outputs. There will be a small Project Committee with representatives from Actuarial Reporting, Cash Flow Testing, and Product Development as well as IT. High-level progress reports on PBA, ORSA, and other actuarial initiatives are an agenda item at quarterly management meetings.

Assumptions and Inputs

Policyholder behavior does not materially impact Term and Whole Life cash flow testing results; however, sensitivity tests show UL is impacted. Current experience studies are in Microsoft

... SR and DR assumptions need to be known at the beginning of the ULSG pricing exercise. Credibility will need to be addressed well beforehand.

Access, and the infrastructure is considered more than adequate for developing PBA assumptions. Experience studies and skills in Access are considered departmental strengths. Data content will be reviewed, and some gaps are expected. One gap is data availability regarding secondary guarantees and analysis of UL premium persistency patterns. Credibility is an issue, and

means to supplement data through additional sources will be explored. ULSG will potentially be reporting SR and DR, and a lower prescribed margin or longer grading period is desirable.

Infrastructure exists to support prescribed methods of developing mortality assumptions, asset defaults, and spreads due to implementing the 2012 version of Actuarial Guideline 38.

However, it was implemented with the short-term goal of December 31, 2012, reporting and not long-term production considerations. No new acceleration of inputs will be made (e.g., early expense close). What is available at that time will be used (estimates and lags are acceptable). Inputs and input processes are well automated and governed. The company would like to automate data validation for inventory statistics such as count, in force amounts, account/cash/market values, and cumulative paid and required specified premiums for secondary guarantees.

The company does not have a formalized view of margins. Historically, one person runs the experience studies and develops or sets the assumptions. The level of conservatism is highly dependent on one person's perspective or beliefs. Some assumptions have been on a best estimate basis only for GAAP and for cash flow testing (e.g., ULSG). The company would like to develop and formalize its philosophy for setting assumptions and margins as well as explicitly frame the methods and definitions for margins. It would like to establish an assumption review team/committee to have more eyes looking at assumptions and the underlying analysis. It would like to develop a feedback and monitoring system. It tracks actual to expected mortality and lapses but does not regularly track other assumptions.

The Road Map's focus on assumptions is not the acquisition or delivery of assumption experience information (i.e., platform, studies, or process) but rather the acceptance, interpretation, and implementation of assumptions and the model outputs they produce. For example, the company will evaluate and analyze the formulas used in dynamic assumptions and the relationship between investment strategy, credited rates, and dynamic lapses and secondary guarantees values and premium persistency and the sensitivity of output values to formula parameter values. The company will use peer review to check the reasonableness of assumptions.

For PBA as well as other business needs, the impact of assumption granularity and model simplifications will be analyzed. For PBA time will be needed to understand the impact of assets assigned to the model segments on DR and SR results. Alternatives include pro rata, newly purchased assets, or benchmarks. During the initial years of PBA the first two alternatives may not be representative of the small percentage of PBA liabilities in force relative to company's management of the entire portfolio.

Model

Three years ago the company purchased a new vendor system. Previously it used two other vendor systems—one for valuation and one for cash flow testing. Conversion has been slow and steady. The company is doing the conversion work. About two-thirds of the product lines and business functions have been converted. The only impact PBA has on the conversion project is the sequencing of the remaining blocks of business, that is, product lines affected by VM before lines not affected by VM.

Assumption philosophy/setting and improving model support of business management decisions are two core competency focal points.

The initial focus of the Road Map is model development not only as it pertains to PBA but also to broader business goals. In the Road Map these goals are referred to as model strengthening, and the models increased use in stages of decision making. Goals include business planning, a better understanding of risk and financial drivers, risk management including uses of reinsurance and derivative instruments, the impact of investment strategies, and ORSA and GAAP. Anticipated changes due to the Insurance Contract Project are an additional and primary consideration in the PBA infrastructure. The accuracy to project SR and DR statutory reserves is not as great as the required accuracy in projecting an equivalent GAAP reserve. The ability to run models with various assumption sets across time periods, to make comparisons, to draw inferences, and to draw conclusions is paramount to supporting business decisions.

Supporting non-PBA uses will lay the foundation for PBA uses. Models on the new system will be modified to support PBA models. Validation will include comparing new and old values, projections, analytics, and reports. Validations will be reviewed for PBA calculations including NPRT, SET, DET, sensitivities, and other requirements as applicable. Model management and governance will reflect the distinct yet interrelated overlaps between PBA, planning, cash flow testing, and risk management models.

Governance

The company has a formal policy regarding the updating and unlocking of GAAP assumptions. Although it performs many of the same activities in developing and documenting assumptions as GAAP, cash flow testing does not have a formal policy. The company does not have assumption-setting policy regarding a formal update, reviewing sign-off procedures, or regarding frequency, storage, location, access, communication, or documentation. First, the company would like to formalize current activities. Second, it would like to enhance its policies balancing good governance and increased work effort. Third, it would like to quantify and grade assumptions based on materiality to differentiate its policies. Governance throughout, from inputs to models to output, will incorporate VM-G and ORSA requirements.

Technology and Systems

Valuation is run on desktops and cash flow testing runs on a server with 24 processors. For both risk management and cash flow testing additional computing capabilities are currently being explored. PBA needs would be satisfied as a result. A computing solution is considered to be a very low risk factor in PBA implementation.

Output

The Road Map calls for an early review of VM-31, VM-50, and VM-51 requirements. During each year-end the Actuarial Opinion and Memorandum (AOM) will be modified where possible to support both the AOM and PBR Actuarial Report (PBRAR) in its structure and language regarding product descriptions, assumptions, methods, and sensitivities. Throughout implementation the company will discuss its PBA plans, intentions, interpretations, and expectations with its external auditor and state regulator as opportunities arise during normal interactions. A review by the state regulator is expected in 2017—18.

Actuarial Organization

Historically reporting valuation and modeling areas were distinct and sought different skill sets and work experiences. Model and database building skills are a departmental strength. Several years ago skill sets in Microsoft Access were elevated to be needed among all actuarial personnel not a specialized few. It was important that a data process not be a black box but that each user knows how and why it works. Due to the converging demands of FASB's Exposure Draft on Insurance Contracts, ORSA, and PBA, the company has decided that all actuarial personnel should possess the following three skill sets: modeling skills—the ability to build and validate; the ability to manage data, processes, and reporting tools; and the ability to sift through results and to analyze and form relationships/implications. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map Initiatives.

Product Development

The term product to be developed in 2015 will be priced on a PBA basis (i.e., NPR). PBA is not expected to affect Whole Life. UL would be priced under PBA in 2019 depending on the magnitude of the excess

The company is keeping its options open and is still deliberating its UL strategy and competitive position.

of the SR or DR over NPR.

Business Planning and Risk Management

Until UL is implemented in 2019, PBA is not expected to alter the acquisition and delivery of business planning and risk management intelligence such as forecasting and attribution analysis since Term reserves will be NPR. Capital budgeting exercises may lead to different decisions than pre-PBA. An ongoing debate within actuarial is the scenarios used for risk management purposes. Should the scenarios be the same as those used for valuation?

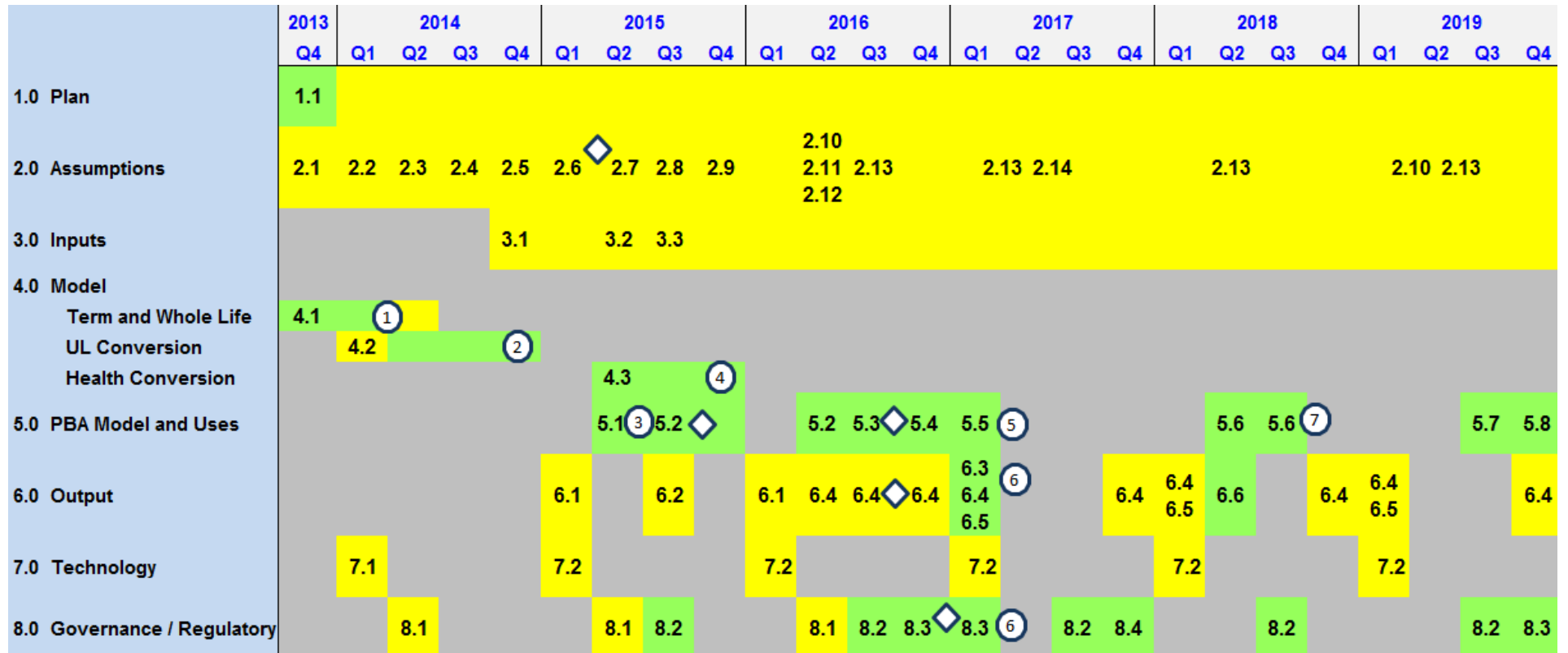
Milestones

- 1 Strengthen Term and Whole Life models and implement into decision making for all business uses including business planning, asset liability management, risk management, and product development (supporting non-PBA uses will lay the foundation for PBA uses)
- 2 Convert and strengthen UL models as in 1
- 3 Build Term NPR, DET, and SET models and processes
- 4 Convert and strengthen Health models as in 1
- 5 Report Term under PBA—perform SERT and DET and report NPR
- 6 Review by audit; submission of VM-50/51 data and PBR Actuarial Report, comply with VM-G
- 7 Build UL NPR, DET, SET, DR, and SR models and processes
- 8 Report UL under PBA—perform SERT and DET and report NPR

Budget

- 1 Targeted consulting reviews spread over six years; \$100,000
- 2 Data solution in the range of \$25,000–35,000 for implementation plus \$5,000 ongoing.

5.4.2 Case Study 2 PBA Implementation Road Map



Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.4.3 Case Study 2 Road Map Initiatives

* Work effort is measured in days and as the *incremental increase due to PBA*

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	20	
2.1	Identify Disclosure requirement gaps: VM-31, VM-50, and VM-51 Identify assumption data requirement gaps: VM-20 Section 9	9 9	
2.2	Continual refinement and improvements (over six years)	48	
2.3	Enhance DR/SR mortality assumption calculations and process Enhance asset default charge process	10 4	
2.4	Formalize existing activities	10	
2.5	Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication, formal sign-off process; procedures pertaining to consistent application of assumptions	24	32
2.6	Develop and formalize philosophy for setting assumptions and margins	10	
2.7	Remediate data capture (premium patterns, policy loans, conversions, and postconversion mortality) and reconciliation gaps	4	60
2.8	Develop actual versus expected analytical tools; feedback/monitoring mechanism	9	
2.9	Explore and secure supplemental data sources (for mortality, lapses)	9	
2.10	Evaluate methods to select starting assets (Term in 2016, UL in 2018)	14	
2.11	Define margin explicitly	5	
2.12	Document assumption and margin methods	5	
2.13	Determine and implement PBA assumptions and margins	10	
2.14	Prudent assumptions for items such as premium patterns, crediting strategies	10	
3.1	Identify input requirement gaps and remediate	4	
3.2	Automate data validation for inventory statistics	9	
3.3	Streamline input interfaces	12	
4.1	Term and Whole Life—strengthen models	22	
4.2	UL—conversion and strengthen models	40	30
4.3	Health—conversion and strengthen models	65	
5.1	Build NPR, SERT, and DET model and processes (including reinsurance)	26	
5.2	Price Term product	24	
5.3	Calculate SERT and DET on June 30, 2016, Term in force	9	
5.4	Reflect PBA Term in business planning	12	
5.5	Report Term using NPR	3	
5.6	Build UL NPR, SR, and DR model and processes (including reinsurance)	52	

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ID #	Initiative	Work Effort*	IT Support*
5.7	Calculate SERT and DET on June 30, 2019, Term, UL, and Whole Life	26	
5.8	Report UL under PBA	18	
6.1	Modify AOM to be consistent where possible with PBRAR requirements	24	
6.2	Modify current statutory analytics for NPR	8	
6.3	Construct Report structure; write Report	14	
6.4	Address auditor issues	10	
6.5	Construct, validate, and submit data requirements	14	20
6.6	Develop SR and DR analyses	36	
7.1	Enhance computing solutions	4	20
7.2	Conduct an annual checkup of model demands and computing power (effort is total not per year)	12	30
8.1	Discuss PBA with state regulator	8	
8.2	Update Model Audit Rule processes and documentation	20	
8.3	VM-G	28	
8.4	State Regulator PBA Review	10	
TOTAL		720	192

5.5 Case Study 3

5.5.1 Case Study 3: Profile

Requirements and Considerations

Current reporting is on a statutory but not on a GAAP basis. Measurement and accountability metrics are statutory earnings and capital, and both are drivers of incentive compensation. Company management is medium; that is, it is not either the conservative or aggressive ends of the spectrum. Life products consist of participating Traditional Whole Life, Competitive Level and non-Level Term, and Accumulation UL and UL with specified premium secondary guarantees (ULSG). Other products include flexible and single-premium fixed deferred annuities, immediate annuities, group annuities, and individual accident and health products. Life premium rates are moderately competitive except for Term, which is more competitive. Product features are conservative. The investment strategy is semiaggressive in areas the company feels it has competencies. There are 800,000 policies in force, and about 15,000 Whole Life, 15,000 UL, and 15,000 Term policies are issued each year.

Business planning takes place three times per year. The financial close schedule is 18 business days. There are three legal life entities and three P/L's for each product line. There are four actuarial departments: Annuity Product Development, Life Product Development, Financial Reporting, and Corporate and Risk Management. Experience studies and business planning reside in Corporate, and cash flow testing resides in Risk Management. Staff involved in reporting, planning, and cash flow testing consists of seven credentialed actuaries, five actuarial students, and three technical support personnel, two of which focus on supporting data management. In 2009 Risk Management evolved from being the cash flow testing area to being charged with ERM. The company is looking to expand its risk analysis with more sensitivities, stress tests, and what-if analyses.

Demands by management in a formulaic statutory paradigm have been for a high degree of accuracy in planning, and even low variances in results are explained. There is not a great degree of volatility in financial results from year to year or quarter to quarter, and forecast variances are small and management has high confidence in using financial intelligence from the actuarial area in evaluating and implementing decisions. Attribution analysis is a critical component facilitating interpretation of financial intelligence. A requirement will be to maintain the same degree of confidence in decision making in a PBA paradigm.

The Road Map timeline assumes VM will become effective January 1, 2016. The intent is to implement PBA for Term for December 31, 2016, to realize expected reductions in reserves and to take the full transition period and implement PBA for Whole Life and UL for December 31, 2019, financials. Hardware and technology expenditures will be a material increase in the actuarial budget. Consultants will be used for thought leadership and to peer review new key PBA methods or processes, especially assumption setting and reasonableness of outputs. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map initiatives.

There will be a small Project Committee with representatives from Actuarial Reporting, Cash Flow Testing, and Product Development as well as IT. High-level progress reports on PBA, ORSA, and other actuarial initiatives are an agenda item at quarterly management meetings.

PBA requirements related to assumptions, inputs, outputs, technology, and governance will be incremental in nature with a few things addressed each year rather than a concerted effort. During the next few years every actuarial department project and company initiative provide an opportunity to include PBA considerations as marginal additions to the project. For each PBA initiative the initial build will be basic, practical, and functional and not necessarily productionalized or industrialized. Then over subsequent periods it will continue to evolve through incremental improvements at each opportunity.

PBA will be fully integrated into product development, business planning, and risk management. Term will be repriced on a PBA basis in 2015 (i.e., NPR). PBA is not expected to affect Whole Life. UL will be repriced on a PBA basis in 2018. The 2016 business plan will reflect PBA as will risk management measures.

Launching a new PBA Term product is a key business requirement. If Term exclusion tests are passed SR and DR reserves and assumptions are not used in financials ...

Assumptions and Inputs

Policyholder behavior does not materially impact term and whole cash flow testing results; however, sensitivity tests show UL is impacted. Current experience studies are in Microsoft

... SR and DR assumptions need to be known at the beginning of the ULSG pricing exercise. Credibility will need to be addressed well beforehand.

SQL, and the infrastructure is considered more than adequate for developing PBA assumptions. Experiences studies and skills in SQL are considered departmental strengths. Data content will be reviewed, and some gaps are expected. One gap is data availability regarding secondary guarantees and analysis on UL premium persistency patterns. Credibility is an issue, and means to supplement

data through additional sources will be explored. ULSG will potentially be reporting SR and DR, and a lower prescribed margin or longer grading period is desirable.

Infrastructure exists to support prescribed methods of developing mortality assumptions, asset defaults, and spreads due to implementing the 2012 version of Actuarial Guideline 38. However, it was implemented with the short-term goal of December 31, 2012, reporting and not long-term production considerations. No new acceleration of inputs will be made (e.g., early expense close). What is available at that time will be used (estimates and lags are acceptable). Inputs and input processes are well automated and governed. The company would like to automate data validation for inventory statistics such as count, in force amounts,

account/cash/market values, and cumulative paid and required specified premiums for secondary guarantees.

The company does not have a formalized view of margins. Historically, one person runs the experience studies and develops/sets the assumptions. The level of conservatism is highly dependent on one person's perspective or beliefs. Some assumptions have been on a best estimate basis for cash flow testing (e.g., ULSG). The company would like to develop and formalize its philosophy for setting assumptions and margins as well as explicitly frame the methods and definitions for margins. It would like to establish an assumption review team/committee to have more eyes looking at assumptions and the underlying analysis. It would like to develop a feedback and monitoring system. It tracks actual to expected mortality and lapses but does not regularly track other assumptions.

The Road Map's focus on assumptions is not the acquisition or delivery (i.e., platform, studies, or process) but rather the acceptance, interpretation, and implementation of assumptions and the model outputs they produce. For example, the company will evaluate and analyze the formulas used in dynamic assumptions and the relationship between investment strategy, credited rates, and dynamic lapses and secondary guarantees values and premium persistency and the sensitivity of output values to formula parameter values. The company will use peer review to check the reasonableness of assumptions.

For PBA as well as other business needs, the impact of assumption granularity and model simplifications will be analyzed. For PBA time will be needed to understand the impact of assets assigned to the model segments on DR and SR results. Alternatives include pro rata, newly purchased assets, or benchmarks. During the initial years of PBA the first two alternatives may not be representative of the small percentage of PBA liabilities in force relative to the company's management of the entire portfolio.

Model

Four years ago the company purchased a new vendor system. Previously it used two other vendor systems: one for valuation and one for cash flow testing. Conversion has been slow and steady. The company is doing the conversion work. About 90% of the product lines and business functions have been converted.

Assumption philosophy/setting and improving model support of business management decisions are two core competency focal points.

The initial focus of the Road Map is model development not only as it pertains to PBA but to broader business goals as well. In the Road Map these goals are referred to as model strengthening, and the models increased use in stages of decision making. Goals include business planning, a better understanding of risk and financial drivers, risk management including uses of reinsurance and derivative instruments, the impact of investment strategies, and ORSA.

With PBA and increased analysis by risk management the models will be run over more scenarios and sensitivities with much greater frequency placing demands on run time. Supporting non-PBA uses will lay the foundation for PBA implementation. Models on the new system will be modified to support PBA models. However, risk management takes a higher level vantage point than forecasting and reporting earnings. The company will not want to sacrifice accuracy in projecting PBA or in its ability to analyze and explain results. Attribution analysis will require additional model runs. The ability to run models with various assumption sets across time periods, to make comparisons, and to draw inferences and draw conclusions is paramount for supporting business decisions.

Validation will include comparing new and old values, projections, analytics, and reports within reason. Audit validations will be reviewed for PBA calculations including NPR, SERT, DET, sensitivities, and other requirements as applicable. Model management and governance will reflect the distinct yet interrelated overlaps between PBA, planning, cash flow testing, and risk management models.

Governance

Cash flow testing does not have an assumption-setting policy regarding a formal update, review of sign-off procedures, or regarding frequency, storage, location, access, communication, or documentation. First, the company would like to formalize current activities. Second, it would like to enhance its policies balancing good governance and increased work effort. Third, it would like to quantify and grade assumptions based on materiality to differentiate its policies. Governance throughout, from inputs to models to output, will incorporate VM-G and ORSA requirements.

Technology and Systems

Valuation is run on desktops, and cash flow testing runs on a server with 12 processors. The company does not sell VAs, so until the risk management requirement for additional analysis there has not been a need for high computing capabilities. PBA analysis will substantially increase the demands. In addition to run time, both risk management and PBA will generate a significant volume of data that will need to be analyzed. Additional computing capabilities and data management platforms are currently being explored. Other than the price tag, computing and data solutions are considered to be a very low risk factor in PBA implementation.

Output

The Road Map calls for an early review of VM-31, VM-50, and VM-51 requirements. During each year-end the Actuarial Opinion and Memorandum (AOM) will be modified where possible to support both the AOM and PBR Actuarial Report (PBRAR) in its structure and language regarding product descriptions, assumptions, methods, and sensitivities. Throughout implementation the company will discuss its PBA plans, intentions, interpretations, and expectations with its external auditor and state regulator as opportunities arise during normal interactions. A review by the state regulator is expected in 2017–18.

Actuarial Organization

Historically reporting valuation and modeling areas were distinct and sought different skill sets and work experiences. Model and database-building skills are a departmental strength. Six years ago the company decided to segregate actuarial responsibilities and data management into specialized skill sets. The company has decided that all actuarial personnel should possess modeling skills: the ability to build and validate and the ability to sift through results and to analyze and form relationships/implications. Data staff should possess the ability to manage data and build processes and reporting tools. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map Initiatives.

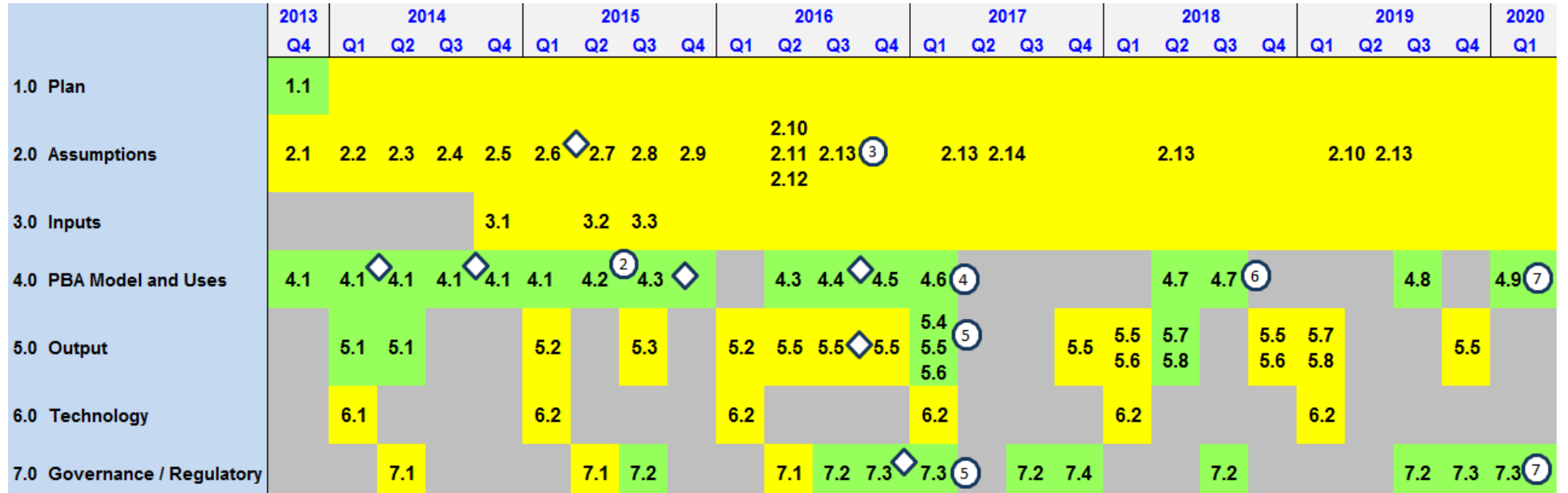
Milestones

- 1 Strengthen models with flexible sensitivity, stress, and what-if capabilities to be incorporated into decision making for all business uses, including business planning, asset liability management, risk management, and product development (supporting non-PBA uses will lay the foundation for PBA uses)
- 2 Build Term NPR, DET, and SET models and processes
- 3 Build PBA assumption and margin methods and processes
- 4 Report Term under PBA: perform SERT and DET and report NPR
- 5 Review by audit; submission of VM-50/51 data and PBR Actuarial Report, comply with VM-G
- 6 Build UL NPR, DET, SET, DR, and SR models and processes
- 7 Report UL under PBA: perform SERT and DET and report NPR

Budget

- 1 Computing solution in the range of \$50,000–75,000 for implementation plus \$15,000 ongoing
- 2 Data solution in the range of \$25,000–35,000 for implementation plus \$5,000 ongoing
- 3 Targeted consulting reviews spread over six years; \$100,000

5.5.2 Case Study 3 PBA Implementation Road Map



Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.5.3 Case Study 3 Road Map Initiatives

* Work effort is measured in days and as the *incremental increase* due to PBA

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	24	
2.1	Identify Disclosure requirement gaps: VM-31, VM-50, and VM-51 Identify assumption data requirement gaps: VM-20 Section 9	9 9	
2.2	Continual refinement and improvements (over six years)	48	
2.3	Enhance SR/DR mortality assumption calculations and process Enhance asset default charge process	12 6	
2.4	Formalize existing activities	10	
2.5	Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication, formal signoff process; procedures pertaining to consistent application of assumptions	24	36
2.6	Develop and formalize philosophy for setting assumptions and margins	18	
2.7	Remediate data capture (premium patterns, policy loans, conversions, and postconversion mortality) and reconciliation gaps	6	60
2.8	Develop actual versus expected analytical tools; feedback/monitoring mechanism	14	
2.9	Explore and secure supplemental data sources (for mortality, lapses)	16	
2.10	Evaluate methods to select starting assets (Term in 2016, UL in 2018)	14	
2.11	Define margin explicitly	10	
2.12	Document assumption and margin methods	10	
2.13	Determine and implement PBA assumptions and margins	18	
2.14	Prudent assumptions such as premium patterns, crediting strategies	12	
3.1	Identify input requirement gaps and remediate	4	
3.2	Automate data validation for inventory statistics	9	
3.3	Streamline input interfaces	12	
4.1	Strengthen models	45	
4.2	Build NPR, SERT, and DET model and processes	26	
4.3	Price Term product	24	
4.4	Calculate SERT and DET on June 30, 2016, Term in force	9	
4.5	Reflect PBA Term in business planning	14	
4.6	Report Term using NPR	2	
4.7	Build UL NPR, SR, and DR model and processes	56	
4.8	Calculate SERT and DET on June 30, 2019, Term, UL, Whole Life	28	
4.9	Report UL under PBA	20	

ID #	Initiative	Work Effort*	IT Support*
5.1	Develop stochastic analyses	70	
5.2	Modify AOM to be consistent where possible with PBRAR requirements	24	
5.3	Modify current statutory analytics and attributions for NPR	8	
5.4	Construct Report structure; write Report	14	
5.5	Address auditor issues	10	
5.6	Construct, validate, and submit data requirements	14	24
5.7	Develop SR and DR analyses	36	
5.8	Develop attribution analyses	70	
6.1	Enhance computing solutions	4	24
6.2	Conduct an annual check-up of model demands and computing power (effort is total not per year)	10	30
7.1	Discuss PBA with state regulator	8	
7.2	Update Model Audit Rule processes and documentation	20	
7.3	VM-G	28	
7.4	State Regulator PBA Review	10	
TOTAL		835	174

5.6 Case Study 4

The distinguishing characteristic of Case Study 4 is that it includes a model conversion. Otherwise it falls between Case Studies 1 and 2 in terms of magnitude. Being able to simultaneously implement PBA and convert model systems was a subject of discussion among participants with recent first-hand experience. If two internal staff could be primarily dedicated to the conversion, participants felt the plan could be successfully executed. If staff were unable to focus on the conversion due to other work demands and only internal resources were used, participants felt failure was a near certainty even with the extended timelines in the Road Map. In this case participants felt external resources were a necessity for a successful outcome. See [Participant's Comments: Actuarial System Conversions](#) for additional comments.

5.6.1 Case Study 4: Profile Requirements and Considerations

Current reporting is on a statutory but not on a GAAP basis. Measurement and accountability metrics are statutory earnings and capital, and both are drivers of incentive compensation. Company management is medium; that is, it is not either the conservative or aggressive ends of the spectrum. Life products consist of Participating Traditional Whole Life, Level Term, and Accumulation UL. Other products include single-premium fixed deferred annuities, immediate annuities, and individual disability income products. Life premium rates are moderately competitive. Product features and investment strategy are conservative. There are 200,000 policies in force, and about 6,000 Whole Life, 1,000 UL, and 10,000 Term policies are issued each year.

Business planning takes place twice per year. The financial close schedule is 25 business days. There are two legal life entities and two P/L's for each product line. There is one actuarial department, and staff consists of two credentialed actuaries, four actuarial students, and one technical support person. Staff currently has no slack capacity and is challenged to support current actuarial functions. The business expectation is that PBA implementation will have a considerable impact on operations and the ability to cost-effectively manage the actuarial function relative to today.

The Road Map timeline assumes VM will become effective January 1, 2016. Significant budget dollars will not be approved until PBA is a near certainty. The Road Map assumes a PBA budget will be approved during the 2014 Q4 budget process. The company will track VM passage by the state legislatures. The intent is to take the full transition period and implement PBA for Whole Life and UL for December 31, 2019, financials. The intent is to implement PBA for Term for December 31, 2016, to realize expected reductions in reserves but only if Term passes both exclusion tests. Preliminary analysis indicates the reduction in reserves and capital to outweigh costs.

The Road Map assumes SET and DET are passed for both Term and UL using the ratio test. Whole Life will pass SET using the certification method (VM-20 6.A.1.a.iii). Once cash flow testing for new term products has been converted, then PBA models will be built and validated.

A preview of SERT will be calculated using best guesses for assumptions and margins. DET and NPR will be calculated.

Verifying SET is passed is a key PBA milestone.

Consultants will be used on a targeted basis to peer review new key PBA methods or processes, especially assumption setting and reasonableness of outputs. Other expenditures on external resources will be minimal as long as progress is being made. Only when it is clear that internal staff will be unable to catch up will external help be engaged. There is no formal Project Committee. IT support and resources will be secured and budgeted. High-level progress reports will be an agenda item at quarterly management meetings.

Other ongoing and future projects will be leveraged to include PBA as a consideration rather than initiatives being formed exclusively for PBA. The ability to piggyback on year-to-year activities (marginally add PBA) is a critical risk factor in successfully implementing PBA. Consultants will be used on a targeted basis, but exactly when and how is not clear and will be determined as the project unfolds.

During the next few years every actuarial department project and company initiative provide an opportunity to include PBA considerations as marginal additions to the project. For each PBA initiative the initial build will be basic, practical, and functional and not necessarily productionalized or industrialized. Then over subsequent periods it will continue to evolve through incremental improvements at each opportunity.

Assumptions and Inputs

Policyholder behavior does not materially impact cash flow testing results due to simplistic and conservative product guarantees and features. Current experience studies are in Microsoft Excel and Access, and the infrastructure is considered adequate for PBA assumptions. The content of data is an item to be reviewed, but major gaps are not expected. One gap is data and analysis on UL premium persistency patterns.

Credibility is an issue, and means to supplement data through additional sources will be explored. As long as SET passes, a higher-margin due to less credibility is acceptable and the need for additional data not essential.

If SET and DET are passed, additional data for credibility will not be pursued.

No infrastructure exists to support prescribed methods of developing mortality assumptions, asset defaults, and spreads. No new acceleration of inputs will be made (e.g., early expense close). What is available at that time will be used (estimates and lags are acceptable).

The company does not have a formalized view of margins. The level of conservatism could vary greatly depending on the personnel. The company would like to develop and formalize its philosophy for setting assumptions and margins. It would like to develop a feedback and monitoring system. It tracks actual to expected mortality and lapses but does not regularly track other assumptions.

The Road Map's initial focus is on assumptions especially term assumptions for SET. For example, an initiative is to build infrastructure for the mortality assumption and margins and asset default spreads. In 2014 the goal is to establish the method and process without concern for the actual values. As part of the implementing PBA assumption initiative another goal is to build the process for generating 16 scenarios (using the American Academy of Actuaries' generator).

Model

Valuation is done using a vendor system on desktops. The company has decided that although its current cash flow testing modeling system is adequate for today's requirements, it is inadequate for the future PBA framework requirements. The company will convert to a new vendor system rather than try to enhance the current system or build an in-house system. They intend to do nearly all the conversion themselves. A conversion coupled with minimal available staff resources causes PBA Implementation to be considerably challenging. The company realizes conversions can be very labor intensive and time consuming, and the conversion is the biggest implementation risk factor regarding calendar time, resources, and completion. It has decided to spread the conversion out over many years. To the extent possible it would like to minimize external staff costs and avoid the need to add an employee.

A model conversion occupies much of the Road Map as each product is staged over multiple years. The basic conversion steps are the same for each product line and only provided once, as sub-items a–l in the Road Map Initiative 4.2 for the Term conversion. The details will differ. For example, Term includes post-Level mortality deterioration and perhaps conversions, Return of Premium features, and coinsurance. Whole Life could include cash values, dividends-elections and options, scale changes, and policy loans. UL would include loads, COIs, surrender charges, credited rates, dynamic crediting strategy, and lapse rates and premium patterns.

The company is looking to implement new and better methods and is not attempting to replicate the old system and methods. Validation will compare new and old values, projections, analytics, and reports. Validations will be reviewed for PBA calculations including NPR, SERT, DET, sensitivities, and other requirements as applicable. Key ongoing decisions during the plan will be when to convert older products and when to convert functions (valuation, business planning, pricing, cash flow testing), and when to parallel and go live with the new system. A critical consideration is converting the statutory reserve valuation to the new system—if, when, and how close.

Input/Output

The Road Map calls for IT personnel to automate input and output processes and some validations performed by the actuarial student and technical staff. By breaking this into small manageable miniprojects, it will be politically and organizationally acceptable. Automation of processes and validation exercises frees up some actuarial staff resources to work on other PBA implementation tasks. This reduces the need for additional external and internal actuarial resources including an increase in staff.

Governance

The company does not have assumption-setting policy regarding a formal update, reviewing sign-off procedures, or regarding frequency, storage, location, access, communication, or documentation. First, the company would like to formalize current activities. Second, it would like to enhance its policies balancing good governance and work effort. Third, it would like to quantify and grade assumptions based on materiality to differentiate its policies. Governance throughout, from inputs to models to output, will incorporate VM-G and ORSA requirements.

Technology and Systems

Run time is an issue, and low cost computing capability alternatives will be evaluated. However, the expectation is that ongoing IT upgrades and improving computing power will be sufficient through 2015. More storage will be needed, but no database or reporting tool purchases are under consideration. A mix of Microsoft Excel and Access are used for experience studies, report production, and analytics. Security controls (e.g., access limitations and locking systems down) also impede speed.

Grids/servers expenditures will be deferred until 2017–18. Expectation is to choose the best option available for \$10,000–20,000 in first year with \$5,000 annually thereafter. “Best” will be defined at that time. Although essential a computing solution is considered to be a very low risk factor in PBA implementation.

Output

The Road Map calls for an early review of VM-31, VM-50, and VM-51 requirements. During each year-end the Actuarial Opinion and Memorandum (AOM) will be modified where possible to simultaneously support the PBR Actuarial Report (PBRAR) and the ORSA Report in structure and language regarding product descriptions, assumptions, methods, and sensitivities. Throughout implementation the company will discuss its PBA plans, intentions, interpretations, and expectations with its external auditor and state regulator as opportunities arise during normal interactions. A review by the state regulator is expected in 2017–18.

Actuarial Organization

If there is staff turnover, three skills will be highly desired in new hires: modeling skills—the ability to build and validate; the ability to manage data, processes, and reporting tools; and the ability to sift through results and to analyze and form relationships/implications. With a small staff specialization is not an option so everyone needs to have or be able to learn these skills to varying degrees. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map Initiatives.

Product Development, Business Planning, and Risk Management

Once Term has been converted to the new system and PBA models have been built (i.e., NPR, DET, SERT) then the next term product to be developed will be priced on a PBA basis (i.e., NPR). The Road Map assumes this will occur in Q2-3 2016. Other life products would follow a similar approach and be priced under PBA in 2019 or later. Since PBA reserves are expected to be the NPR, business planning and risk management would be on a PBA basis once the models are validated and operational.

Launching a new PBA Term product shortly after VM-20 is effective is a key business requirement.

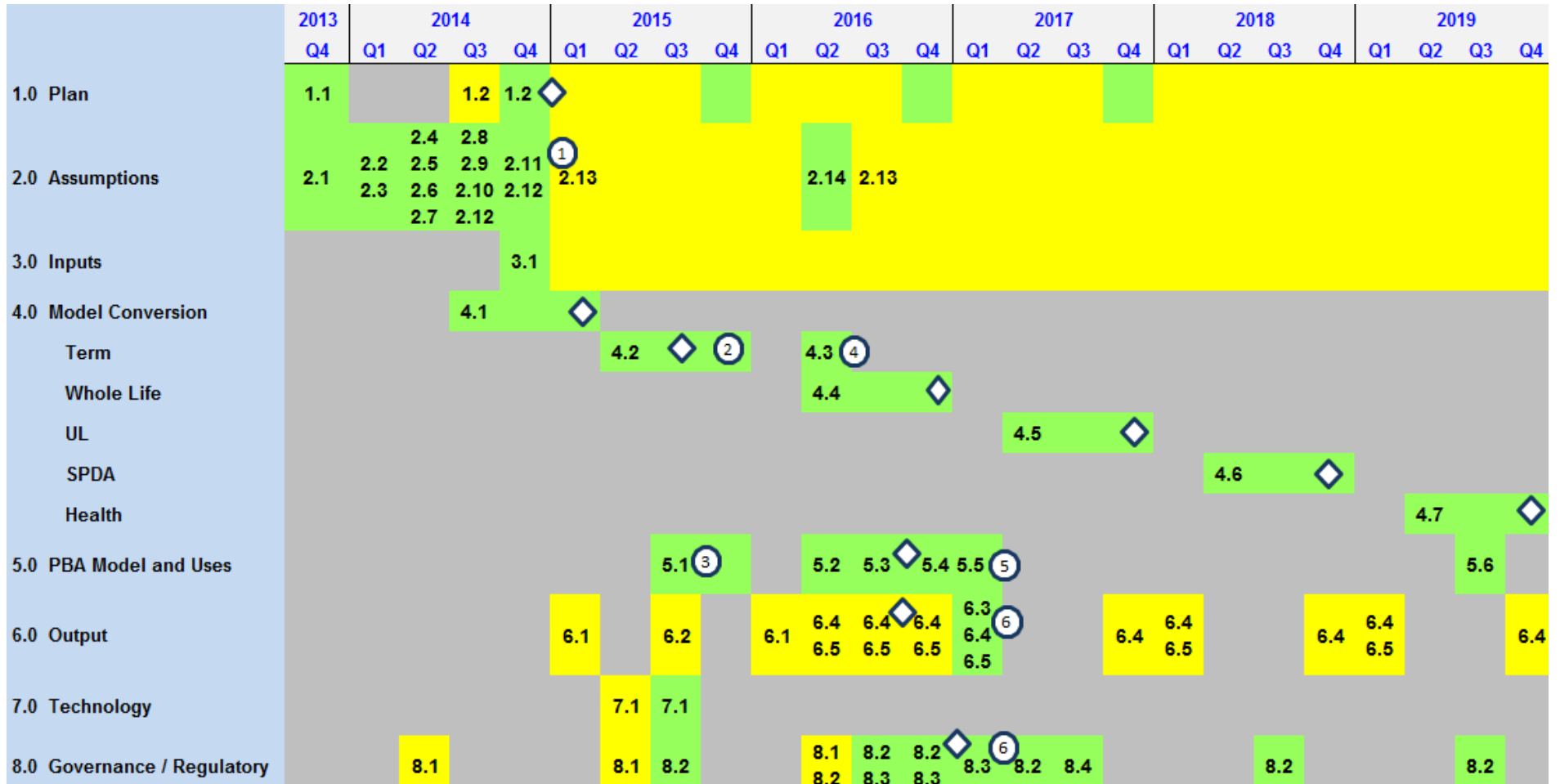
Milestones

- 1 Build PBA assumption and margin methods and processes
- 2 Convert term block to new system; the intermediate target is to convert current products and assets as prerequisite for 3
- 3 Build NPR, DET, and SET models
- 4 Parallel term CFT, which finishes Term conversion
- 5 Report Term under PBA—perform SERT, DET, and report NPR
- 6 Review by audit; submission of VM-50/51 data and PBR Actuarial Report, comply with VM-G

Budget

- 1 Model System: Initial fees: \$250,000–400,000 once all modules and users are licensed; ongoing license fees: \$40,000–100,000; plus modules to be determined
- 2 Computing solution in the range of \$10,000–15,000 for implementation plus \$5,000 ongoing
- 3 Peer review and targeted consulting conversion and implementation help

5.6.2 Case Study 4 PBA Implementation Road Map



Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.6.3 Case Study 4 Road Map Initiatives

* Work effort is measured in days and as the *incremental increase* due to PBA

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	16	
1.2	Secure PBA budget	6	
2.1	Identify disclosure requirement gaps: VM-31, VM-50, and VM-51 Identify assumption data requirement gaps: VM-20 Section 9	8 8	
2.2	Formalize existing activities	8	
2.3	Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication, formal sign-off process; procedures pertaining to consistent application of assumptions	16	40
2.4	Develop and formalize philosophy for setting assumptions and margins	10	
2.5	Remediate data capture (premium patterns, policy loans, conversions, and postconversion mortality) and reconciliation gaps	8	60
2.6	Explore supplemental data sources (for mortality, lapses)	6	
2.7	Develop DR/SR mortality assumption calculations and process	22	
2.8	Develop asset default charge process	10	
2.9	Define margin explicitly	5	
2.10	Document assumption and margin methods	5	
2.11	Develop actual versus expected analytical tools; feedback mechanism	10	
2.12	Prudent assumptions	10	
2.13	Continual refinement and improvements (over six years)	48	
2.14	Determine and implement PBA assumptions and margins	12	
3.1	Identify input requirement gaps and remediate	6	
3.2	Automate data validation for inventory statistics	6	16
3.3	Streamline input interfaces	8	32
4.1	RFP, budget process, evaluate, select, purchase	16	
4.2	Convert Term		
a	Build and validate Extract to Inventory interface and process		
b	Create assumption and coding conventions		
c	Code/Model product and asset parameters		
d	Code/Model assumptions and margins		
e	Run and validate statutory valuation: iterate		
f	Run and validate baseline projection: iterate		
g	Run and validate sensitivities: iterate		
h	Build and validate reports, analytics, output interfaces		
i	Incorporate supplemental benefits and riders		
		140	15

ID #	Initiative	Work Effort*	IT Support*
j	Incorporate reinsurance		
k	Documentation—methods, validations, processes		
l	Day-2 activities		
4.3	Run post-parallel 2015 Term CFT	8	
4.4	Convert Traditional Whole Life Subitems a–l from 4.2	90	
4.5	Convert UL Subitems a–l from 4.2	90	
4.6	Convert SPDA Subitems a–l from 4.2	90	
4.7	Convert Health Subitems a–l from 4.2	90	
5.1	Build NPR, SERT, and DET model and processes	26	
5.2	Price Term product	24	
5.3	Calculate SERT and DET on June 30, 2016, Term in force	9	
5.4	Reflect PBA Term in business planning	12	
5.5	Report Term using NPR	3	
5.6	Calculate SERT and DET on June 30, 2019, Term, UL, Whole Life	20	
6.1	Modify AOM to be consistent where possible with PBRAR requirements	24	
6.2	Modify current statutory analytics for NPR	8	
6.3	Construct Report structure; write Report	14	
6.4	Address auditor issues	10	
6.5	Construct, validate, and submit data requirements	12	20
7.1	Evaluate and implement computing power technologies	4	28
8.1	Discuss PBA with state regulator	8	
8.2	Update Model Audit Rule processes and documentation	6	
8.3	VM-G	24	
8.4	State Regulator PBA Review	10	
TOTAL		966	211

5.7 Case Study 5

A real Road Map would integrate VM-20 implementation with other company initiatives including GAAP proposals. However, this is beyond the scope of this Guide and this Case Study.

5.7.1 Case Study 5: Profile Requirements and Considerations

The company intends to implement PBA for all products when VM becomes effective, assumed for this Road Map to be January 1, 2016. PBA implementation is simply one of many large projects the company and the actuarial functions will have in the next five years.

Current reporting is on a statutory and GAAP basis. Measurement and accountability metrics are GAAP earnings, growth in GAAP equity, and statutory capital levels. GAAP earnings are a driver of incentive compensation. Life products consist of nonparticipating Traditional Whole Life, Competitive Level and non-Level Term, Accumulation UL and UL with secondary guarantees (ULSG) with multiple shadow accounts, Index UL (IUL), Variable UL (VUL), and Life Long-Term Care Combo products. Other products include flexible and single-premium fixed deferred annuities, variable annuities with many various guarantee living benefit riders (VAGLBs), immediate annuities, group annuities, and individual accident and health products. Company management is semiaggressive. It is not trying to be a market leader in the more aggressive products such as ULSG and Index UL. Life premium rates are competitive, and the company continually launches new products. The investment strategy is semiaggressive in areas the company feels it has competencies. There are 2,000,000 policies in force, and about 10,000 Whole Life, 15,000 ULSG, 10,000 IUL, 25,000 Accumulation UL, 5,000 VUL, and 35,000 Term policies are issued each year.

Business planning takes place five times per year: during the quarterly financial close plus next year's business plan during October to December. The financial close schedule is 18 business days. There are 10 legal life entities and five to 10 P/L's for each product line. The company has numerous divisions, and products are distributed through multiple channels each with its own P/L. There are eight actuarial departments. Demands by management have been for extensive amounts of planning and evaluation of different growth strategies and risk implications. Experience studies and business planning reside in Corporate, and cash flow testing resides in Risk Management. Staff involved in reporting, planning, and cash flow testing consists of 25 credentialed actuaries, 12 actuarial students, and five technical support personnel.

The company implemented Economic Capital (EC) two years ago, which it calculates three times per year, and incorporates EC into its risk management framework and business planning. The company plans to add four actuaries to staff: two in 2014 and two in 2015 due to the increased demands for resources in the current business environment and increase in decision intelligence acquired through sensitivities and what-ifs, analyzing EC, implementing ORSA in 2015, potential changes in GAAP, implementing and operating PBA, and proliferating governance requirements. In addition to evaluating model compression, the company is considering using a one-quarter lag in its PBA reporting.

A PBA Steering Committee was formed in the spring of 2012. The largest expenditure will be the additional staff, although PBA is merely one of many reasons to add staff. Training, getting up to speed on VM-20, and making interpretations are implicit rather than explicitly defined in the Case Study Road Map. Consultants will be used on a targeted basis to peer review new key PBA methods or processes, especially assumption setting and reasonableness of outputs. During the next few years every actuarial project and company initiative provide an opportunity to include PBA considerations as marginal additions to the project. For each PBA initiative the initial build will be basic, practical, and functional and not necessarily productionalized or industrialized. Then over subsequent periods it will continue to evolve through incremental improvements at each opportunity. Due to VAGLB products, some capabilities, infrastructure, and processes exist that will facilitate PBA implementation, for example, grid and data processing, running stochastic models, and analyzing stochastic reserves.

Assumptions and Inputs

Considerable effort is expected in assumption setting. Experience studies reside in an online analytic processing (OLAP) database. In its gap analysis the company has determined it is capturing the required data. The company has been analyzing premium patterns and secondary guarantees in conjunction with running sensitivities. The company has participated in SOA and LIMRA industry policyholder behavior studies. The company also participates in data calls, specifically New York, so it does not expect a gap in data requirements for VM-31/50/51 other than unknown future developments.

The company established an assumption committee two years ago charged with governance, approval processes, frequency of review of assumptions, and documentation. One evolving benefit is the centralized development, setting, and approval of neutral views on assumptions. In 2013 a centralized assumption repository/library was implemented documenting what assumptions were used for model-produced business information ranging from final product pricing assumptions to business planning assumptions to asset adequacy assumptions to reporting assumptions. The company has classified assumptions by materiality. However, the classification is on a GAAP basis, not a PBA basis. The committee needs to establish a philosophy for setting assumptions and margins. Its philosophy on assumptions and margins will evolve, and it will not likely produce original ideas but draw from emerging industry practices. The company wishes to explore issues such as granularity, consistency, changing assumptions, changing methods, and their impact on results. It will be important to classify assumptions according to materiality. This will be important for allocating resources.

Infrastructure exists to set prescribed methods of developing mortality assumptions, asset defaults, and spreads due to implementing the 2012 version of Actuarial Guideline 38. That implementation took considerable effort over six weeks by two employees. The expectation is that nonprescribed policyholder assumptions based on judgment will be more challenging and require more time and resource to analyze as well as several layers of oversight and review. With EC the company has been evaluating the impact of assumption granularity, the formulas used in dynamic assumptions and the relationship between investment strategy, credited rates, and dynamic lapses and secondary guarantees values and premium persistency and the

sensitivity of output values to dynamic formula input parameter values. Understanding relationships between assumptions, emerging experience, changes, and financial results will require a learning curve. See the Output section. The company will use peer review to check the reasonableness of assumptions.

Model

The company has been using one vendor system for five years and relies on the various models for its many actuarial functions. There are 30 different liability models and 10 asset models used across the business functions and product lines, several thousand assumption tables, and dozens of processes. Models have a segregation of duties between developers and users.

The company participated in the SOA PBA field test/impact study. The company also evaluated the impact on their current product offerings of the FASB Insurance Contracts Discussion Paper published in September 2010. Both these projects required considerable resources. One lesson was that the reserve does not always change like you think it might with changes in assumptions. These projects and the insights learned will reduce the amount of resource required to build the PBA models. To build all the PBA models will still be a considerable endeavor as will new controls, new validation tools, and model documentation. Validation will include comparing new and old values, projections, analytics, and reports. Validations will be reviewed for PBA calculations, sensitivities, and other requirements as applicable.

EC models use a model compression algorithm that is appropriate for the use and decision intelligence EC provides. The company will need to explore and refine compression for PBA

Model compression is integral to the company's PBA strategy, and its application and usage of models—facilitating more analysis, attributions, and insights into business drivers—need to balance compression with accuracy.

and GAAP models. For Actuarial Guideline (AG) 43 the company uses very little compression because it does not feel comfortable enough with compressed results to use in financials and business planning. One issue is that while the compression may be acceptably close to a full or lower compressed version at a given point in time, will the compression remain reasonable after a shock and/or the passage of time? Will the

models need be compressed every quarter or will an annual compression exercise be sufficient? The company expects exploration of compression methods to be a critical component of PBA statutory and GAAP models and to require significant resources to develop appropriate methods.

During implementation of AG43 the company spent a significant amount of time over a 12-month time frame on validation within their internal actuarial function and internal audit and with their external auditor and state regulator. PBA implementation of models will be fully integrated with other modeling activities. Model management and governance will reflect the distinct yet interrelated overlaps between PBA, planning, cash flow testing, and risk management models. The ability to run models with various assumption sets across time periods, to make comparisons, to draw inferences, and to draw conclusions is paramount to

supporting business decisions. Once models are built as products are repriced the company will reevaluate products under PBA, GAAP, and Economic Capital.

Governance

Implementing and operating AG43 have driven governance development and changes over the past few years. The company needs to enhance its governance to a PBA paradigm. Evaluating PBA for both statutory and GAAP highlighted numerous issues to be addressed in a production reporting environment versus an ad hoc testing environment. Governance throughout, from inputs to models to output, will incorporate VM-G and ORSA requirements.

Technology and Systems

Valuation is run on servers; cash flow testing and EC run on a well-sized grid. IT implemented grids initially for VA needs. EC and AG38 have created incremental needs. PBA will necessitate additional requirements. An observation is that investment in technology has been significant, but reporting, cash flow testing, analysis, and actuarial tasks do not take any less time than pre-grid days from 10–15 years ago. Product and model complexity seems to have grown at a faster rate than computing capabilities. The company needs to explore simplifications in order to exploit future technology developments. Security controls (e.g., access limitations and locking systems down) also impede speed.

Output

With principle-based approaches affecting statutory and GAAP financial results, the complexity and interconnectedness of many moving parts in products, policyholder behavior, and the external environment, significant resources and time are needed to develop appropriate analytics and understand relationships. This will not just be the case during implementation but will continue to require significant resources in the fast-changing business environment. An ongoing challenge will be to compare assumptions and emerging experience at different periods and to explain impacts on statutory PBA, EC, and GAAP results when the events and circumstances of the time periods might be very different. Currently PBA Life models (e.g., cash flow testing) acquire information but do not transform results into intelligence (e.g., explanations). It will take time to validate and accept results, to interpret model output, and to implement into actions.

A precursory look at VM-31, VM-50, and VM-51 requirements has been made. A detailed gap analysis will occur in 2014. During each year-end the Actuarial Opinion and Memorandum (AOM) will be modified where possible to simultaneously support the PBR Actuarial Report (PBRAR) and the ORSA Report in structure and language regarding product descriptions, assumptions, methods, and sensitivities. Throughout implementation the company will discuss its PBA plans, intentions, interpretations, and expectations with its external auditor and state regulator as opportunities arise during normal interactions. A review by the state regulator is expected in 2017–18.

Actuarial Organization

Skill sets are developed and grow organically by being exposed to or immersed in the work

environment and work demands. All actuarial students will get a rotation in the modeling area. The company has been steadily adding to actuarial staff to fulfill its modeling needs. There is not enough slack in reporting to pick up all the implementation work and operate once implemented. A primary challenge will be how to manage the financial close. Actuaries have not received much database training. There are a few that perform most of the data work. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map Initiatives.

Knowledge management will require special attention. Many small groups of two or three will be dedicated to implementing the dozens of initiatives, not just for PBA implementation but also for ORSA and GAAP. Each initiative will require learning and implementing many highly specialized and technical details. This knowledge will need to be acquired and then transferred to develop depth and address business continuity concerns.

The company tends not to hire consultants for implementation work and believes that it is best to perform internally. Management will be reluctant to engage consultants other than for peer review and thought leadership. With the extent of new paradigms in PBA statutory, GAAP, and ORSA and demand implications, the actuarial area has concerns that if and when consultants are needed, availability will be limited (i.e., concerned that 2016 will be the actuarial equivalent of IT's Y2K). Concern also exists with respect to recruiting and retaining the right people and skills because other companies will also be vying for the same people and skills.

GAAP is the basis for business planning in conjunction with EC for risk management. PBA is not expected to alter the acquisition and delivery of business planning and risk management. Capital budgeting exercises may lead to different decisions than pre-PBA.

Milestones

- 1 Build Term NPR, DET, and SET and Whole Life DET models and reporting/planning processes
- 2 Evaluate and implement compression and lag methods
- 3 Build UL SET, DET, SR, and DR models and processes starting with Accumulation UL followed by ULSG
- 4 Develop assumption and margin philosophies and determine PBA assumptions and margins
- 5 Finish UL: IUL and VUL
- 6 Develop DR and SR analyses
- 7 Implement PBA into 2016 business plan
- 8 Report PBA financial results; review by audit
- 9 Submit PBR reports, submit data requirements, comply with VM 20/31/50/51, VM-G

Budget

- 1 Additional staff (average salary and benefit of \$120,000 per year per employee)
- 2 \$250,000 in upgrades to staff. As staff turns over upgrades in skill sets and capabilities are continually being made in their replacements.
- 3 \$50,000 for consultant peer review
- 4 \$50,000 for incremental computing costs

5.7.2 Case Study 5 PBA Implementation Road Map

	2013	2014				2015				2016				2017			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2		
1.0 Plan	1.1																
2.0 Assumptions	2.1	2.2 2.3	2.4 2.5 2.9	2.6 2.7 2.8	2.10 2.11	4	2.12	2.12			2.12	2.12			2.12		
3.0 Inputs			3.1 3.2	3.3 3.4													
4.0 PBA Models			4.5	4.5	4.5	4.5	4.5	4.6	7		4.7	4.7	8	4.7	4.7		
Compression & Lag		4.1	4.1 4.2	4.1 4.2	2												
Term & Whole Life		4.3	4.3	1													
UL		4.4	4.4	4.4	3	4.4	4.4	4.4	5								
5.0 Output		5.1 5.2		5.4 5.6	5.6	5.1 5.6	6	5.4			5.5	5.4 5.5 5.6	5.3 5.4	5.4 5.5	5.3 5.4 5.5	9	
6.0 Technology		6.1				6.1					6.1						
7.0 Governance / Regulatory			7.1	7.2	7.2		7.2	7.2 7.3	7.1 7.3			7.2 7.3	7.2 7.3		7.2	9	7.4

Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.7.3 Case Study 5 Road Map Initiatives

* Work effort is measured in days and as the *incremental increase* due to PBA

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	32	
2.1	Rationalize or remediate manual processes and data corrections	36	
2.2	Enhance DR/SR mortality assumption calculations and process	10	
2.3	Enhance asset default charge process	10	
2.4	Develop and formalize philosophy for setting assumptions and margins	24	
2.5	Define margin explicitly	28	
2.6	Document assumption and margin methods	24	60
2.7	Classify assumptions according to materiality	14	
2.8	Develop actual versus expected analytical tools; feedback mechanism	14	40
2.9	Evaluate methods to select starting assets	14	
2.10	Determine prudent assumptions for items such as premium patterns and crediting strategies	68	
2.11	Determine and implement stochastic assumptions and prescribed assumptions and margins	28	
2.12	Assumption refinements (Day-2/Phase II)	32	
3.1	Identify input requirement gaps	10	
3.2	Remediate gaps	10	60
3.3	Streamline input interfaces	28	100
3.4	Input change management	18	100
4.1	Evaluate and implement model compression methods	170	
4.2	Evaluate impacts of lag reporting and develop adjustment processes	45	
4.3	Build Term NPR and Term/Whole Life DET and SERT models and reporting/planning processes	90	60
4.4	Build UL DET, SET, and SERT models and reporting/planning processes	90	60
4.5	PBA Model validation	180	
4.6	Implement PBA into 2016 business plan	24	
4.7	Report PBA financial results	28	
5.1	Modify AOM to be consistent where possible with PBRAR requirements	32	
5.2	Modify current statutory analytics for NPR	10	
5.3	Construct Report structure; write Report	24	
5.4	Discuss with auditor and address auditor issues	72	
5.5	Construct, validate, and submit data requirements	54	
5.6	Develop SR and DR analyses	90	
6.1	Enhance computing solutions	5	60
7.1	Discuss PBA with state regulator	28	
7.2	Update SOX and Model Audit Rule processes and documentation	54	
7.3	VM-G	36	
7.4	State Regulator PBA Review	14	
TOTAL		1,446	540

5.8 Case Study 6

A real Road Map would integrate VM-20 implementation with other company initiatives including GAAP proposals. However, this is beyond the scope of this Guide and this Case Study.

5.8.1 Case Study 6: Profile Requirements and Considerations

The company intends to implement PBA for all products when VM becomes effective, assumed for this Road Map to be January 1, 2016. PBA implementation is simply one of many large projects the company and the actuarial functions will have in the next five years.

Current reporting is on a statutory and GAAP basis. Measurement and accountability metrics are GAAP earnings, growth in GAAP equity, and statutory capital levels. GAAP earnings are a driver of incentive compensation. Life products consist of nonparticipating Traditional Whole Life, Competitive Level and non-Level Term, Accumulation UL and UL with secondary guarantees (ULSG) with either specified premiums or a single shadow account, and Index UL (IUL) and Variable UL (VUL). Other products include flexible and single-premium fixed deferred annuities, variable annuities with many various guarantee living benefit riders (VAGLBs), immediate annuities, group annuities, and individual accident and health products. Company management is aggressive, and the company tends to be an innovative market leader in ULSG, IUL, and Combo products. Life premium rates are competitive, and the company continually launches new products to offer new features introduced in the market. The investment strategy is semiaggressive in areas the company believes it has competencies. There are 1,400,000 policies in force, and about 10,000 Whole Life, 25,000 ULSG, 15,000 IUL, 5,000 Accumulation UL, 2,000 VUL, and 20,000 Term policies are issued each year.

Business planning takes place five times per year: during the quarterly financial close plus the next year's business plan during October to December. The financial close schedule is 15 business days. There are five legal life entities and three to seven P/L's for each product line. The company has numerous divisions, and products are distributed through multiple channels, each with its own P/L. There are five actuarial departments: Annuity Product Development, Life Product Development, Financial Reporting, Corporate, and Risk Management. Demands by management have been for a high degree of accuracy in planning, and even low variances in results are explained. Attribution analysis is a critical component facilitating interpretation of financial intelligence. Experience studies and business planning reside in Corporate, and cash flow testing resides in Risk Management. Staff involved in reporting, planning, and cash flow testing consists of 15 credentialed actuaries, eight actuarial students, and three technical support personnel.

The company recently implemented Economic Capital (EC), which it calculates twice per year, and incorporates EC into its risk management framework and business planning. The company plans to add three or four actuaries to staff from 2014 to 2017, one per year, due to the increased demands for resources in the current business environment and increase in decision intelligence acquired through sensitivities and what-ifs, analyzing EC, implementing ORSA in

2015, potential changes in GAAP, implementing and operating PBA, and proliferating governance requirements.

The company formed a PBA Steering Committee in the spring of 2012. The largest expenditure will be the additional staff although PBA is merely one of many reasons to add staff. Training, getting up to speed on VM-20, and making interpretations are implicit rather than explicitly defined in the Case Study Road Map. Consultants will be used on a targeted basis to peer review new key PBA methods or processes, especially assumption setting and reasonableness of outputs. Those most concerned with PBA are not the decision makers regarding budget and resources to devote to PBA implementation. Management will wait until the last moment if manpower is needed for implementing PBA. During the next few years every actuarial department project and company initiative provide an opportunity to include PBA considerations as marginal additions to the project. For each PBA initiative the initial build will be basic, practical, and functional and not necessarily productionalized or industrialized. Then over subsequent periods it will continue to evolve through incremental improvements at each opportunity. Due to VAGLB products, some capabilities, infrastructure, and processes exist that will facilitate PBA implementation, for example, grid and data processing, running stochastic models, and analyzing stochastic reserves.

Assumptions and Inputs

Generating stochastic scenarios will be a moderate challenge. Validating scenario output is a greater challenge. Considerable effort is expected in assumption setting. For its enterprise data needs the company recently purchased an online analytic processing (OLAP) database. Initially the data and business intelligence efforts have been focused on supporting marketing. Experience studies will convert to the OLAP platform during 2014–15. Moving input data in addition to experience data to a central data storage repository will be a huge project. The database conversion is a separate project and is not included in the PBA Road Map. Assumption requirements not related to the conversion are included in the Road Map. The company has identified gaps in its data/analysis for policyholder behavior assumptions for its newer and more complex ULSG and IUL products. Additional data will be needed in UL to reflect premium patterns and secondary guarantees. Adding data fields with the numerous data platforms and interfaces and complying and updating Sarbanes-Oxley and Model Audit Rule processes and documentation will be challenging and require many hours, especially by IT. The company has not previously incorporated industry data into assumptions because it has set assumptions based on its own experience data and forward-looking views on assumptions such as inflation and mortality improvement.

A major challenge in setting assumptions will be to attain consistency between business units and functions. The company does not have an established philosophy for setting assumptions and margins, nor does it have an established policy to explicitly frame the methods and definitions for assumptions and margins. The company is forming a committee with personnel from various areas to have oversight over the assumption process to address issues such as granularity, consistency, changing assumptions, changing methods, and other governance issues. Actual versus expected analytical tools will have to be built and used to report and

explain assumption trends and tie them to business impacts. It will be important to classify assumptions according to materiality. This will be important for allocating resources.

Infrastructure exists to set prescribed methods of developing mortality assumptions, asset defaults and spreads due to implementing the 2012 version of Actuarial Guideline 38. That implementation took considerable effort over two months by three employees. The expectation is that nonprescribed policyholder assumptions based on judgment will be more challenging and require more time and resource to analyze as well as several layers of oversight and review. With EC the company has been evaluating (1) the impact of assumption granularity, (2) the formulas used in dynamic assumptions, and (3) the relationship between investment strategy, credited rates, dynamic lapses, secondary guarantees values, and premium persistency, and (4) the sensitivity of output values to dynamic formula input parameter values. Understanding relationships between assumptions, emerging experience, changes, and financial results will require a learning curve. See the Output section. The company will use peer review to check the reasonableness of assumptions.

Model

The company has used one vendor system for over eight years and relies on the various models for its many actuarial functions. There are 60 different liability models and 15 asset models used across the business functions and product lines, several thousand assumption tables, and dozens of processes. Models have a segregation of duties between developers and users.

The company participated in the field test/impact study for two of their current products, which took three or four staff dedicated to the project two months. To build all the PBA models will be a significant endeavor as will new controls, new validation tools, and model documentation. Validation will include comparing new and old values, projections, analytics, and reports. Validations will be reviewed for PBA calculations, including NPR, SET, and DET sensitivities, and other requirements as applicable. Model management and governance will reflect the distinct yet interrelated overlaps between PBA, planning, cash flow testing, and risk management models. The ability to run models with various assumption sets across time periods, to make comparisons, and to draw inferences and conclusions is paramount to supporting business decisions.

The company will revisit the models for every product and study the implications. As models are built as products are repriced, the company will reevaluate products under PBA, GAAP, and EC. PBA implementation of models will be fully integrated with other modeling activities.

During implementation of Actuarial Guideline (AG) 43, the company spent a significant amount of time over a 12-month time frame on validation within their internal actuarial function and internal audit and with their external auditor and state regulator.

Governance

Implementing and operating AG43 have driven governance development and changes over the past few years. The company has a formal policy regarding the updating, unlocking, and sign-off

process of GAAP assumptions. Cash flow testing does not have a formal policy. The company does not have an enterprise assumption-setting policy with respect to formal updates or review sign-off procedures or a policy with respect to frequency, storage, location, access, communication, or documentation. First, the company would like to formalize current activities. Second, it would like to enhance its policies balancing good governance and work effort. Third, it would like to quantify and grade assumptions based on materiality to differentiate its policies. Governance throughout, from inputs to models to output, will incorporate VM-G and ORSA requirements.

Technology and Systems

Valuation is run on servers; cash flow testing and EC run on a well-sized grid. IT implemented grids initially for VA needs. EC and AG38 have created incremental needs. PBA will necessitate additional requirements. An observation is that investment in technology has been significant, but reporting, cash flow testing, analysis, and actuarial tasks do not take any less time than pre-grid days from 10 to 15 years ago. Product and model complexity seems to have grown at a faster rate than computing capabilities. The company needs to explore simplifications in order to exploit future technology developments. Security controls (e.g., access limitations and locking systems down) also impede speed.

Output

With principle-based approaches affecting statutory and GAAP financial results, the complexity and interconnectedness of many moving parts in products, policyholder behavior, and the external environment, significant resources and time are needed to develop appropriate analytics and understand relationships. This will not just be the case during implementation but will continue to require significant resources in the fast-changing business environment. An ongoing challenge will be to compare assumptions and emerging experience at different periods and to explain impacts on statutory PBA, EC, and GAAP results when the events and circumstances of the periods might be very different. Currently PBA life models (e.g., cash flow testing) acquire information but do not transform results into intelligence (e.g., explanations). It will take time to validate and accept results, to interpret model output, and to implement into actions.

A precursory look at VM-31, VM-50, and VM-51 requirements has been made. A detailed gap analysis will occur in 2014. During each year-end the Actuarial Opinion and Memorandum (AOM) will be modified where possible to simultaneously support the PBR Actuarial Report (PBRAR) and the ORSA Report in structure and language regarding product descriptions, assumptions, methods, and sensitivities. Throughout implementation the company will discuss its PBA plans, intentions, interpretations, and expectations with its external auditor and state regulator as opportunities arise during normal interactions. A review by the state regulator is expected in 2017–18.

Actuarial Organization

All actuarial students will get a rotation in the modeling area. The company has been steadily adding to actuarial staff to fulfill its modeling needs. There is not enough slack in reporting to

pick up all the implementation work and operate once implemented. A primary challenge will be how to manage the financial close. Actuaries have not received much database training. There are a few that perform most of the data work. Training, getting up to speed on VM-20, and making interpretations are implicit within the Case Study Road Map Initiatives.

Knowledge management will require special attention. Many small groups of two or three will be dedicated to implementing the dozens of initiatives, not just for PBA implementation but also for ORSA and GAAP. Each initiative will require learning and implementing many highly specialized and technical details. This knowledge will need to be acquired and then transferred to develop depth and address business continuity concerns.

The company tends not to hire consultants for implementation work and believes that it is best to perform internally. Management will be reluctant to engage consultants other than for peer review and thought leadership. With the extent of new paradigms in PBA statutory, GAAP, and ORSA and demand implications, the actuarial area has concerns that if and when consultants are needed, availability will be limited (i.e., they are concerned that 2016 will be the actuarial equivalent of IT's Y2K). Concern also exists with respect to recruiting and retaining the right people and skills because other companies will also be vying for the same people and skills.

GAAP is the basis for business planning in conjunction with EC for risk management. PBA is not expected to alter the acquisition and delivery of business planning and risk management. Capital budgeting exercises may lead to different decisions than pre-PBA.

Milestones

- 1 Build Term NPR, DET, and SET, Whole Life DET and Accumulation UL DET and SERT models, and reporting/planning processes
- 2 Develop Assumption governance policies; implement policies; develop assumption and margin philosophies
- 3 Build ULSG SET and SR models and processes
- 4 Build VUL DR and SR models and processes
- 5 Develop DR and SR analyses
- 6 Build IUL DR and SR models and processes
- 7 Implement PBA into 2016 business plan
- 8 Set PBA assumptions and margins
- 9 Report PBA financial results; review by audit
- 10 Submit PBR Reports, submit data requirements, comply with VM 20/31/50/51, VM-G

Budget

- 1 Additional staff (average salary and benefit of \$120,000 per year per employee)
- 2 \$250,000 in upgrades to staff. As staff turns over upgrades in skill sets and capabilities are continually being made by their replacements.
- 3 \$50,000 for consultant peer review
- 4 \$50,000 for incremental computing costs

5.8.2 Case Study 6 PBA Implementation Road Map

	2013	2014				2015				2016				2017	
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1.0 Plan	1.1														
2.0 Assumptions	2.1	2.2	2.3	2.4	2.9										
			2.6	2.5	2.10	2.12									
			2.7	2.8	2.11	2.13	2.14	2.15	2.14	2.18	2.18				
			2.8	2.11	2.12	2.17			2.18	2.19	2.19	2.21			
			2.10	2.12	2.13										
			2.11	2.20	2.16										
3.0 Inputs			3.1	3.2	3.2	3.3	3.4								
4.0 PBA Models			4.7	4.7	4.7	4.7	4.7	4.8			4.9	4.9	4.9	4.9	
Term	4.1	4.1													
Whole Life		4.2													
Accumulation UL	4.3	4.3													
ULSG			4.4	4.4											
VUL				4.5	4.5										
IUL					4.6	4.6									
5.0 Output	5.1		5.4	5.6	5.1	5.4				5.5	5.4	5.3	5.4	5.3	
	5.2		5.6	5.6	5.6	5.4				5.5	5.4	5.5	5.4	5.5	
6.0 Technology	6.1					6.1				6.1					
7.0 Governance / Regulatory			7.1	7.2	7.2		7.2	7.2	7.1		7.2	7.2		7.2	
								7.3	7.3		7.3	7.3		7.2	

Key: Focus Moderate/Incremental No or little work effort ① Milestone ◇ Other Target/Deliverable

Decimal numbers correspond to the itemized initiative ID no. in the Case Study Road Map Initiatives.

5.8.3 Case Study 6 Road Map Initiatives

* Work effort is measured in days and as the *incremental increase* due to PBA

ID #	Initiative	Work Effort*	IT Support*
1.1	Develop initial Road Map plan	32	
2.1	Form assumption committee	8	
2.2	Identify disclosure requirement gaps: VM-31, VM-50, and VM-51	24	
	Identify assumption data requirement gaps: VM-20 Section 9	28	
2.3	Rationalize or remediate manual processes and data corrections	36	
2.4	Enhance SR/DR mortality assumption calculations and process	10	
2.5	Enhance asset default charge process	10	
2.6	Formalize existing activities	18	
2.7	Classify assumptions according to materiality	24	
2.8	Establish policies facilitating consistency and meeting business needs	14	
2.9	Develop centralized development, setting, and approval of neutral views of assumptions	14	
2.10	Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication, formal sign-off process; procedures pertaining to consistent application of assumptions	28	40
2.11	Develop and formalize philosophy for setting assumptions and margins	28	
2.12	Remediate data capture and reconciliation gaps	24	80
2.13	Develop actual versus expected analytical tools; feedback/monitoring mechanism	24	40
2.14	Explore incorporation of industry data and reports in assumption setting	18	
2.15	Evaluate methods to select starting assets	14	
2.16	Define margin explicitly	14	
2.17	Document assumption and margin methods	14	
2.18	Determine prudent assumptions for items such as premium patterns and crediting strategies	70	
2.19	Determine and implement stochastic assumptions and prescribed assumptions and margins	28	
2.20	Implement a centralized location for assumption storage (e.g., internal share point)	54	80
2.21	Identify input requirement gaps	18	
3.1	Assumption refinements (Day-2/Phase II)	36	
3.2	Remediate gaps	18	80
3.3	Streamline input interfaces	28	100
3.4	Input change management	18	100
4.1	Build Term NPR, DET, and SERT models and reporting/planning processes	90	30
4.2	Build Whole Life DET models and reporting/planning processes	28	30
4.3	Build Accumulation UL DET and SERT models and reporting/planning processes	90	20

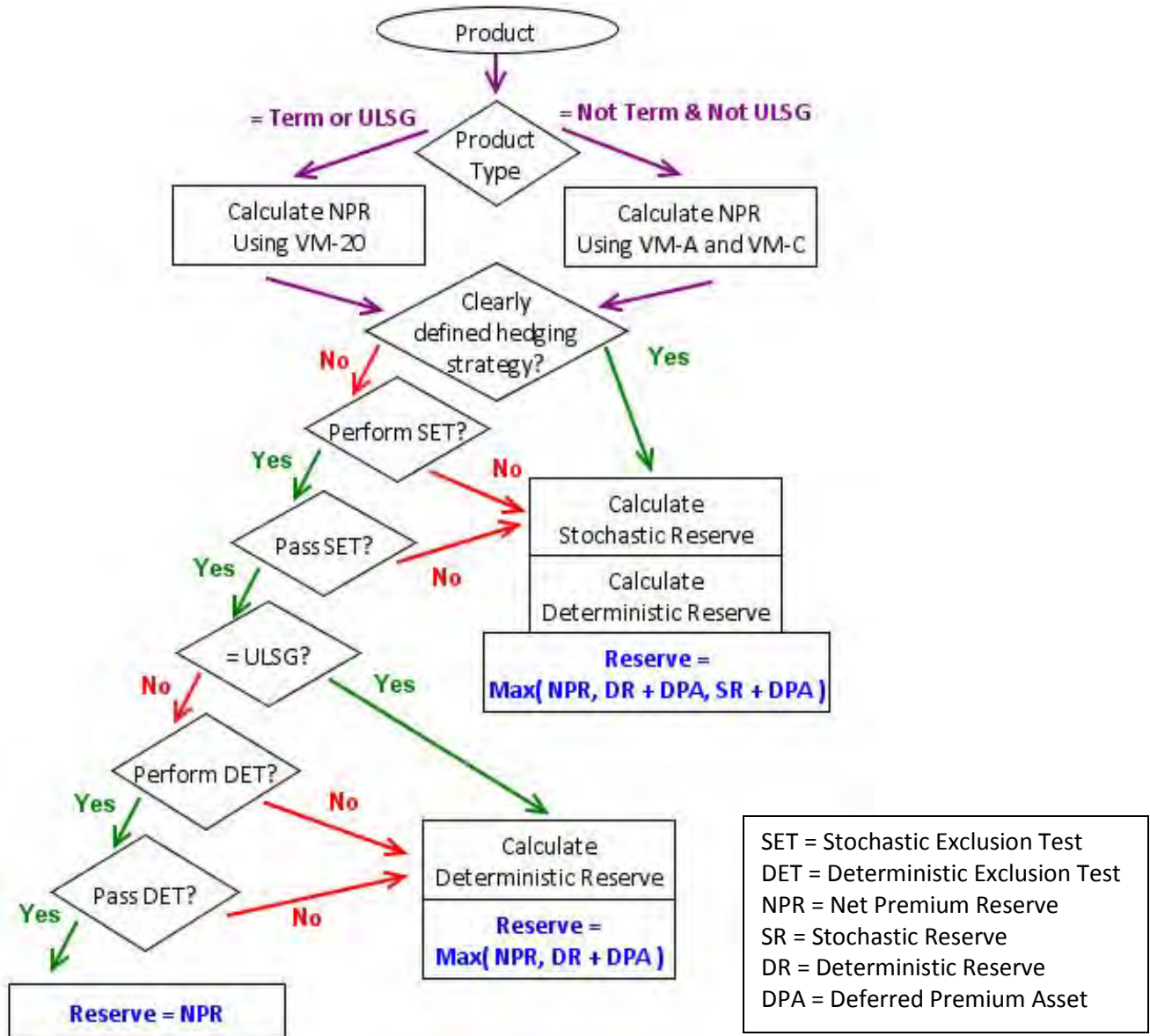
ID #	Initiative	Work Effort*	IT Support*
4.4	Build ULSG SET and SR models and reporting/planning processes	110	20
4.5	Build VUL DR and SR models and reporting/planning processes	90	20
4.6	Build IUL DR and SR models and reporting/planning processes	110	20
4.7	PBA Model Validation	180	
4.8	Implement PBA into 2016 business plan	24	
4.9	Report PBA financial results	28	
5.1	Modify AOM to be consistent where possible with PBRAR requirements	32	
5.2	Modify current statutory analytics for NPR	10	
5.3	Construct Report structure; write Report	24	
5.4	Discuss with auditor and address auditor issues	72	
5.5	Construct, validate, and submit data requirements	28	
5.6	Develop SR and DR analyses	90	
6.1	Enhance computing solutions	5	60
7.1	Discuss PBA with state regulator	28	
7.2	Update SOX and Model Audit Rule processes and documentation	54	
7.3	VM-G	36	
7.4	State Regulator PBA Review	14	
TOTAL		1,795	720

6 Flow Charts and Tables

The Valuation Manual is 240 pages, VM-20 is 71 pages, the prescribed Mortality Assumption is 11 pages, and the Practice Note is more than 100 pages. If a picture is worth a thousand words, the Flow Charts are intended to portray a high-level view perspective and convey some detail to facilitate forming a view of your future PBA framework, deconstructing applicable VM-20 requirements into substeps, and constructing the initiatives in your Road Map.

Warning: The Flow Charts cannot reflect all possible cases or capture all the important detail. Flow charts are not a substitute for the original source material: VM-20.

6.1 Product Decision Tree (see [Scoping Guide Product Applicability and Decision Tree](#))



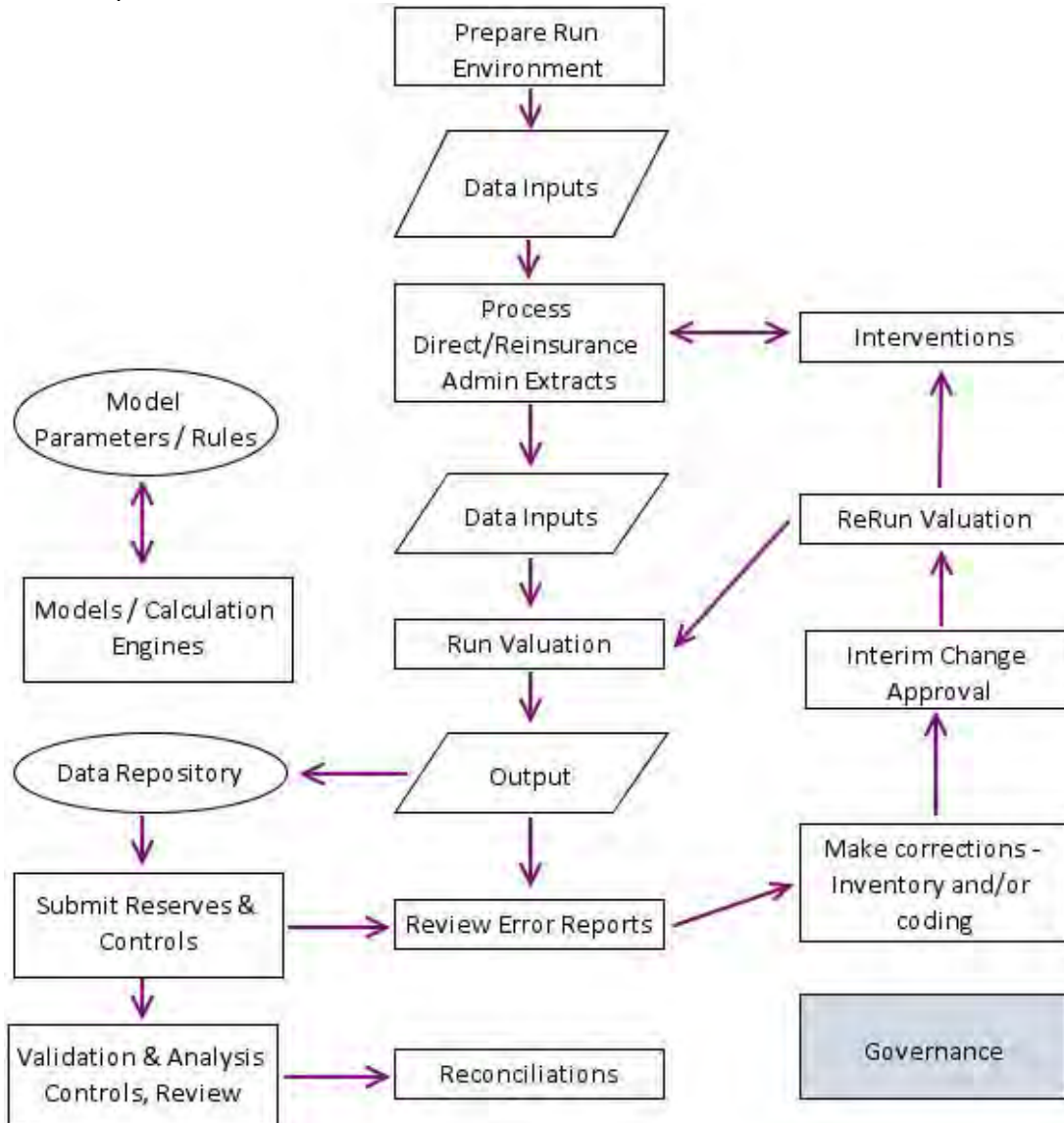
6.2 Potential Reserve Applicability

(see [Scoping Guide Product Applicability and Decision Tree](#))

	NPR	SET	DET	SR	DR
Traditional	Yes: VM-A/C	Pass	Pass	No	No
Term (if gross premiums > net premiums)	Yes: VM-20	Maybe	Pass	Maybe	Maybe
Term (if gross premiums < net premiums)	Yes: VM-20	Maybe	Fail	Maybe	Yes
ULSG	Yes: VM-20	Fail	NA	Yes	Yes
UL without SG	Yes: VM-A/C	Pass	Pass	No	No
Variable Life	Yes: VM-A/C	Maybe	Pass	No	No
Index UL	Yes: VM-A/C	NA	NA	Yes	Yes

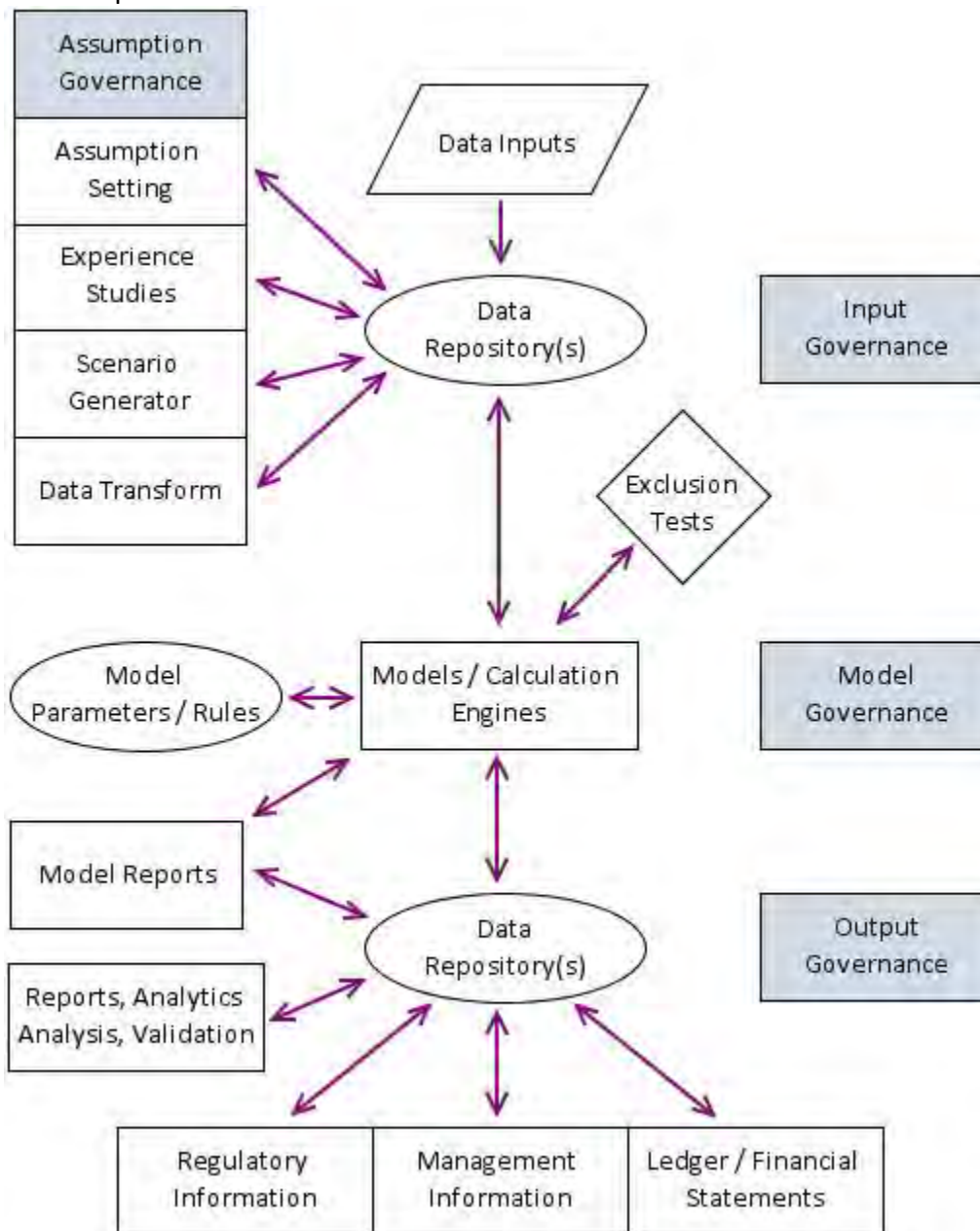
6.3 Current Valuation Flow (see [Scoping Guide Current Framework](#))

The gray “Governance” box is associated with all the other boxes – governance is not an exercise performed in a silo.



6.4 PBA Operational Flows (see [Scoping Guide PBA Framework](#))

The gray “Governance” boxes are associated with the other boxes – governance is not an exercise performed in a silo.



Potential off-cycle activities (not during financial close) include

- Perform exclusion tests
- Set assumptions (reflecting a policy regarding frequency and updating)
- Run experience studies
- Perform assumption sensitivities
- Perform some validations and audit activities
- Document

6.5 Self-Assessment Evaluation Report Card

(See [Scoping Guide Evaluate the current versus PBA framework](#))

Block/Line of Business: _____	Grade of Current		Magnitude of Change		Resource to Change		Importance	Desired Grade PBA Framework
	FR*	CFT*	FR	CFT	FR	CFT		

Assumption setting

1	Experience studies and other information								
2	Processes and analytical engines								
3	Setting assumptions and margins								
4	Assumption governance and documentation								

Inputs

5	Input management								
6	Input process								
7	Input governance and documentation								
8	Supports business and reporting requirements								

Model Platforms (Throughputs)

9	Update, maintain, operate, validate								
10	Flexible, robust								
11	Net Premium Reserve								
12	Deterministic Reserve								
13	Stochastic Reserve								
14	Model governance and documentation								

Outputs

15	Output management								
16	Output process and analytical engines								
17	Output governance and documentation								
18	Analysis and explanations								
19	Supports business and reporting requirements								

Technology and Systems

20	Hardware, database, nonmodel applications								
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Actuarial Organization

21	Organization chart/structure, culture								
22	Competencies, skill sets, and knowledge								

Other

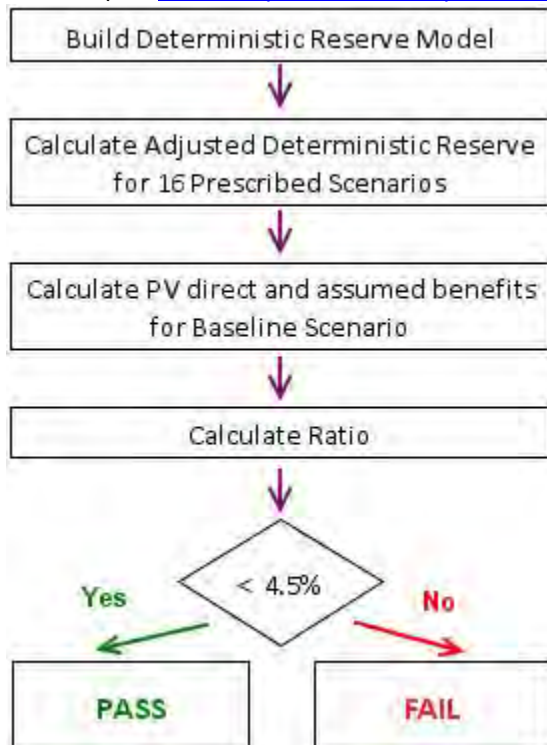
23	Run time versus processing time versus analysis time								
24	Production environment								
25	Knowledge management								
26	Product development								
27	Risk management								

* FR: Financial Reporting
Grade: A/B/C/D/E/NA

CFT: Cash Flow Testing/Modeling
Score: 1–10/minimal–significant

6.6 Stochastic Exclusion Ratio Test

(see [Road Map Guide Assumption Setting SERT](#) and [Road Map Guide Model Platform SERT](#))



$$Ratio = \frac{Max_A DR' - DR'_B}{PV_B(direct \ \& \ assumed \ Benefit)}$$

DR' = DR except no margins are applied

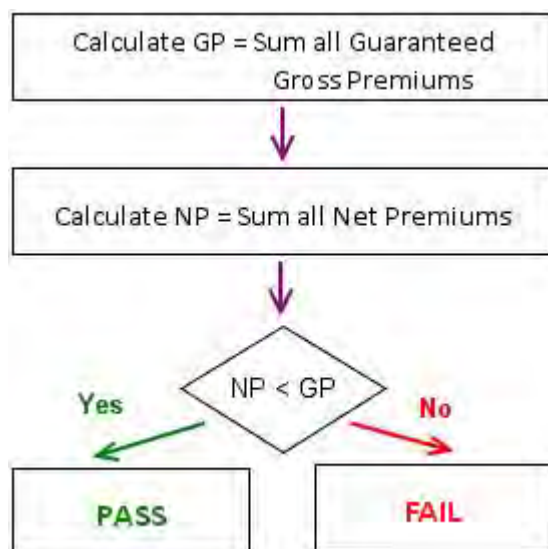
B = Baseline Scenario (#9)

A = Scenarios {1–8 and 10–16}

Contract types with significantly different risk profiles may not be grouped

6.7 Deterministic Exclusion Test

(see [Road Map Guide Assumption Setting DET](#) and [Road Map Guide Model Platform DET](#))



Test is on a direct or assumed basis

Sums without taking present values

Contract types with significantly different risk profiles may not be grouped

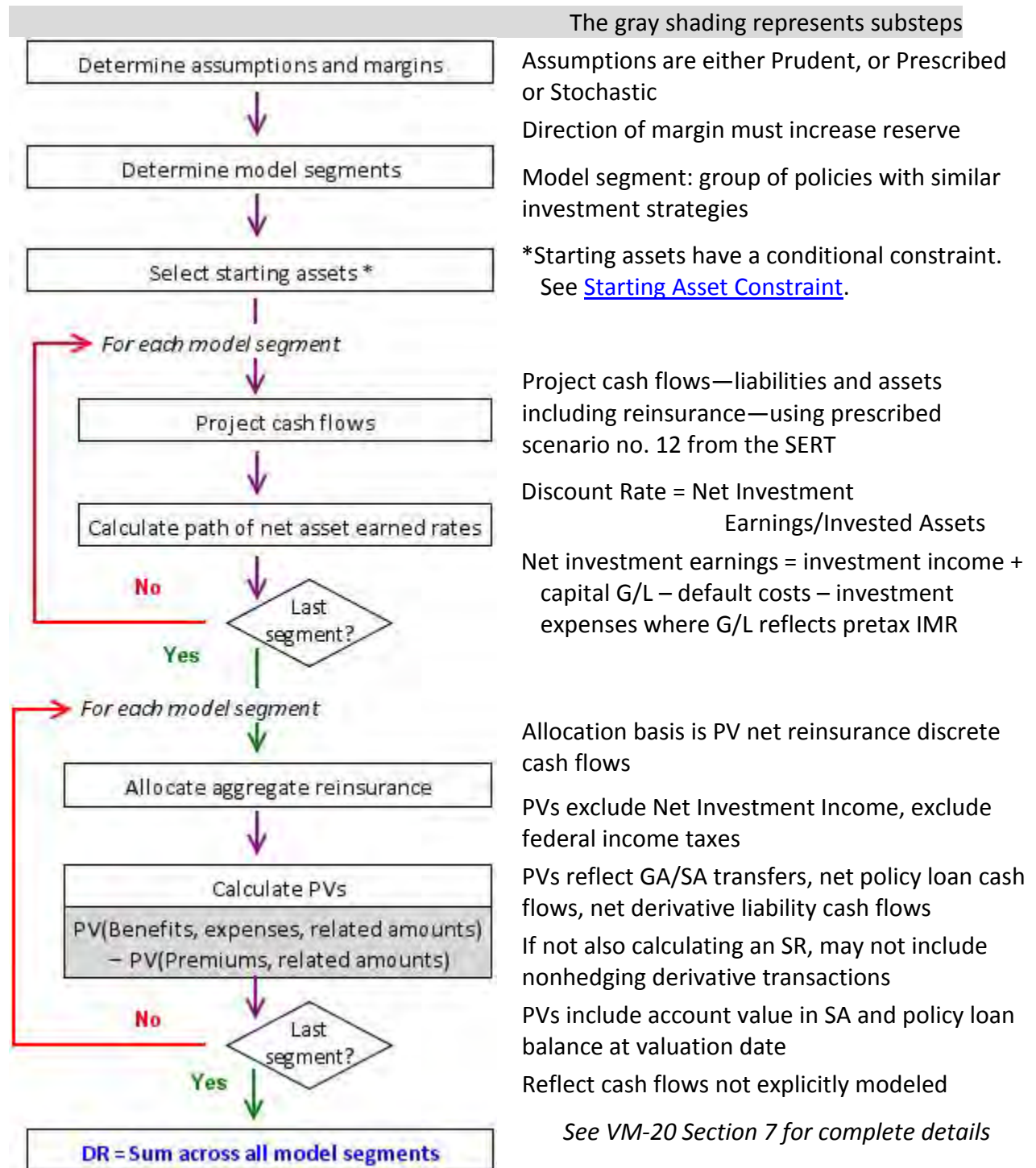
If NPR applied 3.A.1, then determine NP using lapse rates equal to 0

If NPR was subject to shock lapses, then limit sum to initial level period

If anticipated mortality > valuation mortality, then use anticipated to determine net premium

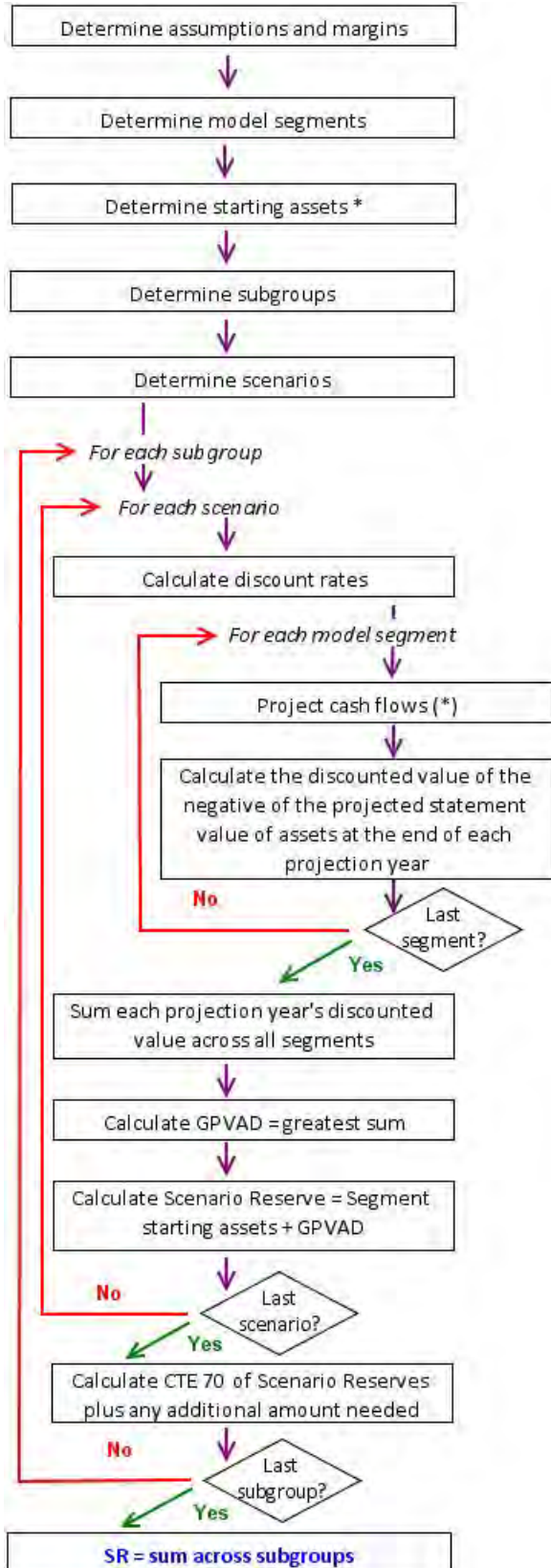
6.8 Deterministic Reserve (DR)

(see [Road Map Guide Assumption Setting DR](#) and [Road Map Guide Model Platform DR](#))



6.9 Stochastic Reserve (SR)

(see [Road Map Guide Assumption Setting SR](#) and [Road Map Guide Model Platform SR](#))



Assumptions are either Prudent, or Prescribed or Stochastic

Direction of margin must increase reserve

Model segment: group of policies with similar investment strategies

*Starting assets have a conditional constraint. See [Starting Asset Constraint](#).

Subgroup: group of segments with similar/integrated risk management strategies

Stochastic scenarios are prescribed; which ones and how many are not prescribed

Discount Rate = 105% of one-year Treasury rates

Project cash flows—liabilities and assets including reinsurance similar to DR

* Starting assets have a conditional constraint: See [Starting Asset Constraint Flow Chart](#)

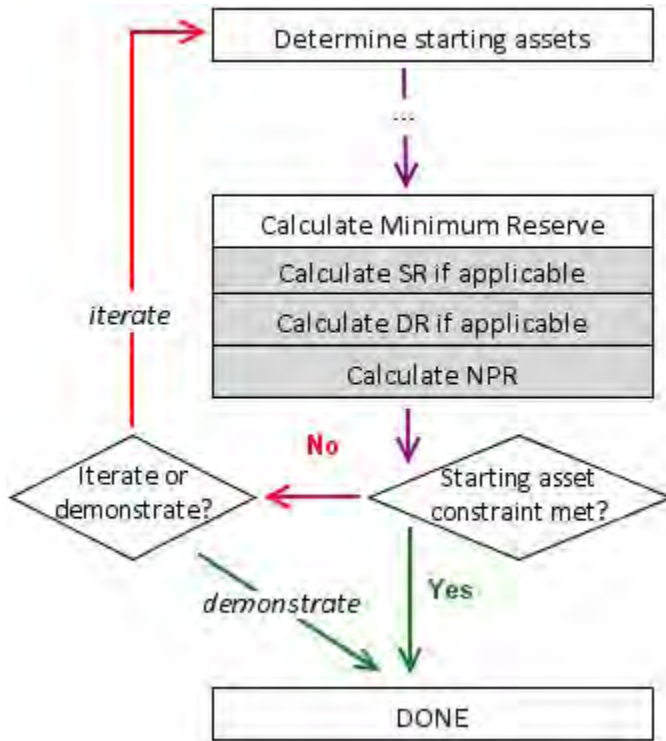
See VM-20 Section 7 for complete details

GPVAD = Greatest Present Value of Accumulated Deficiencies

Determine any additional amount needed to capture any material risk included in the scope of these requirements but not already reflected in the cash flow models using an appropriate and supportable method and supporting rationale.

6.10 Starting Asset Constraint

(see [Road Map Guide Model Platform Starting Asset Constraint](#))



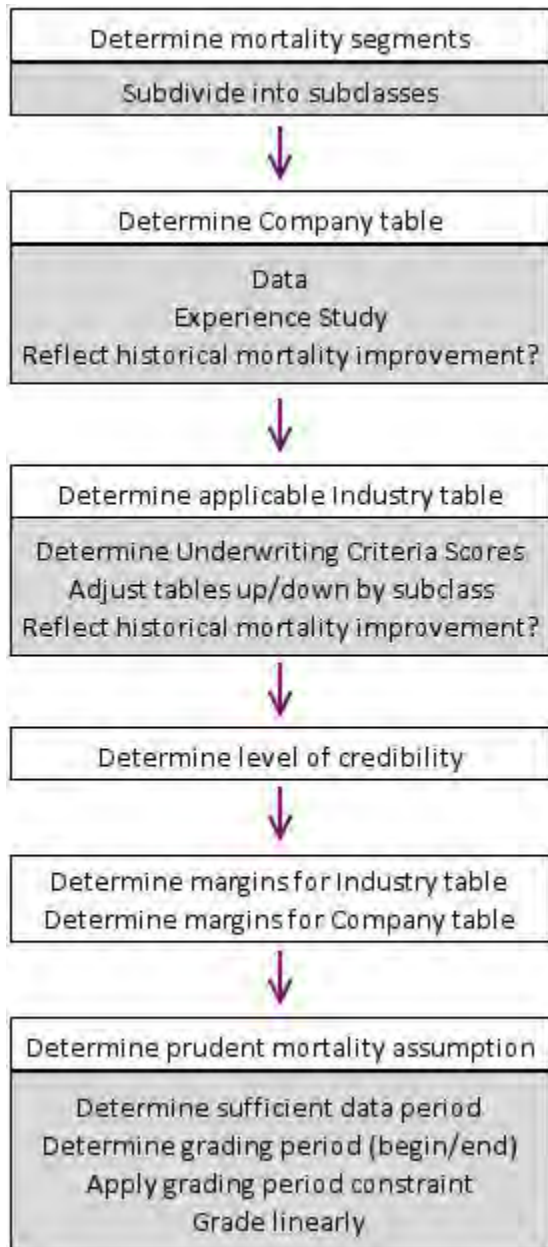
The gray shading represents substeps

7.D.1.c

If for all model segments combined, the aggregate annual statement value of starting assets is less than 98% or greater than the larger of NPR or 102% of the final aggregate modeled (whether stochastic or deterministic) reserve, the company shall provide documentation in the PBR Actuarial Report that provides reasonable assurance that the aggregate modeled reserve is not materially understated as a result of the estimate of the amount of starting assets.

6.11 Stochastic and Deterministic Reserve Mortality Assumption

(see [Road Map Guide Assumption Setting Mortality](#))



The gray shading represents substeps

$3 \leq \text{Experience Study Period} \leq 10 \text{ exposure years}$

No improvement beyond valuation date

Historical improvement from the central point of data to the valuation date permitted

Adjust up/down two tables by subclass

In taking into account factors that are not recognized in the underwriting scoring algorithm

No improvement beyond valuation date

Historical improvement from the central point of data to the valuation date permitted

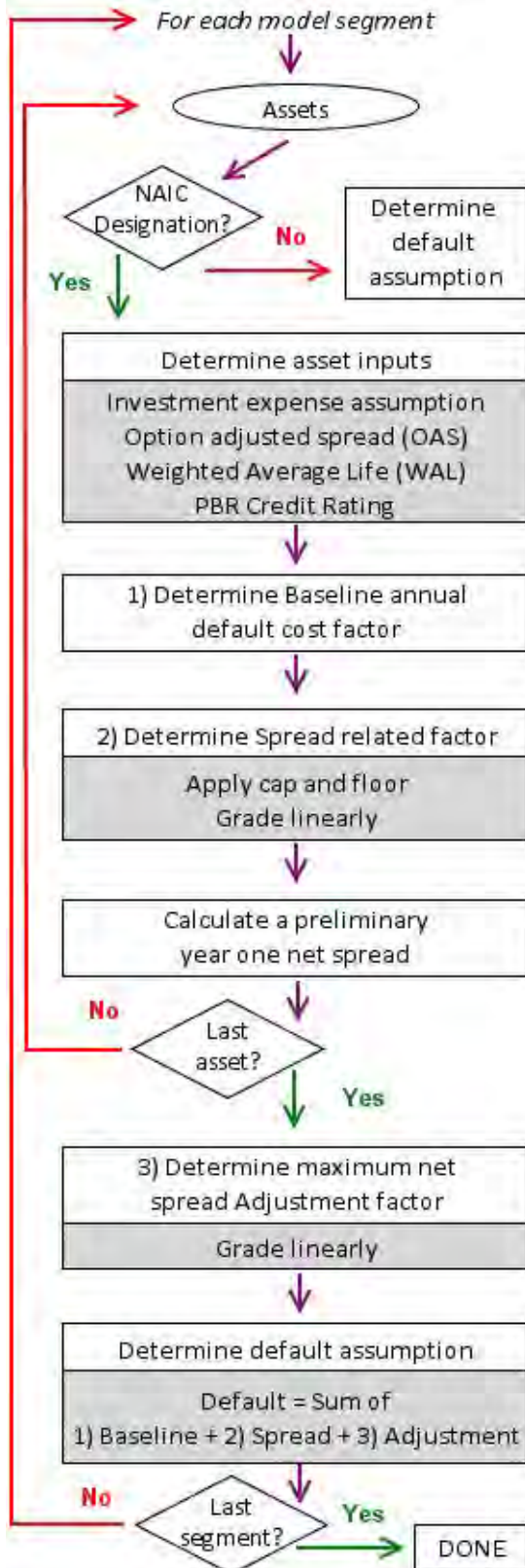
Aggregate level of credibility over the entire exposure period using common/acceptable methodology

Credibility Level and Attained Age determine Margins

Separate prescribed margin tables for industry/company

6.12 Stochastic and Deterministic Reserve Asset Default Assumption

(see [Road Map Guide Assumption Setting Asset Assumptions](#))



The gray shading represents substeps

NO: Fixed income assets without an NAIC designation such as commercial mortgage loans and residential mortgages: default is such that the net yield is capped at 104% of applicable historical U.S. Treasury yield rate plus 25 basis points

YES: Fixed income assets with an NAIC designation such as corporate bonds, preferred stocks, RMBS, CMBS: default cost = sum of three components

Inputs are used to determine factors

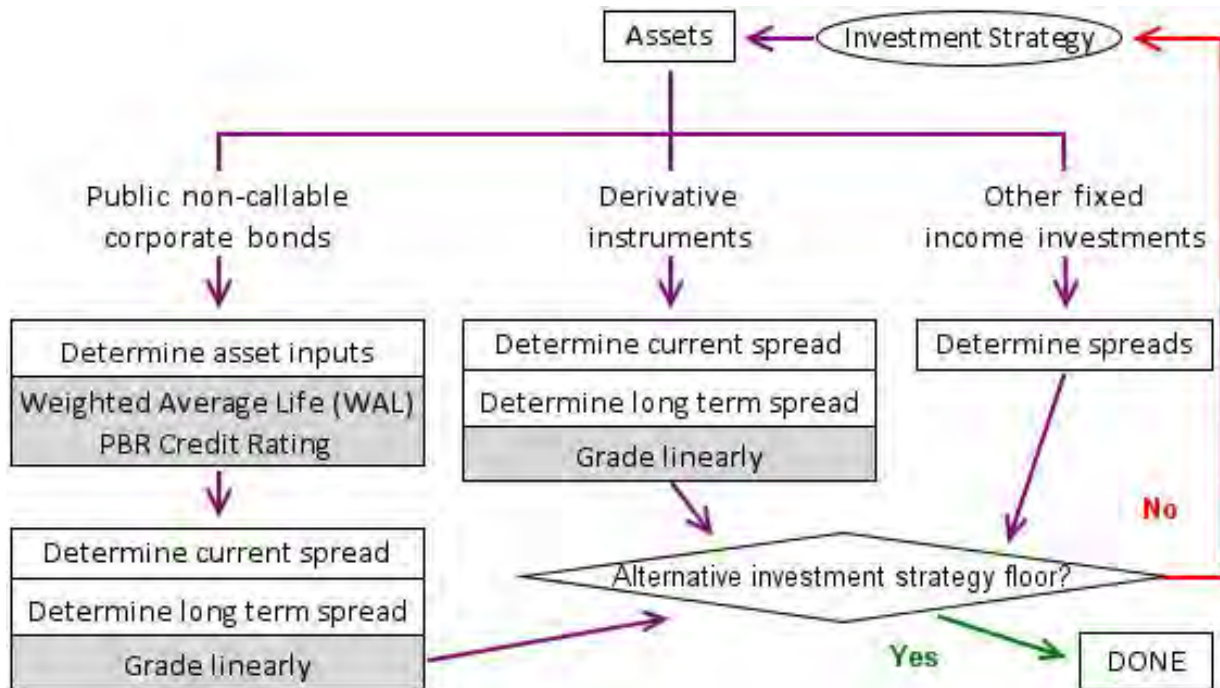
1) Baseline annual default cost factor: determined at asset level, a table lookup based on PBR credit rating and WAL

2) Spread related factor: determined at asset level, based on current and historical spreads, can be positive or negative, grades to zero in projection year 4

3) Maximum net spread adjustment factor: determined at model segment level. Based on comparison of option adjusted spread net of defaults as of valuation date between weighted average of assets in model segment and a benchmark of PBR 9 bonds. Positive only, grades to zero in projection year 4.

6.13 Stochastic and Deterministic Reserve Asset Gross Spread Assumption

(see [Road Map Guide Assumption Setting Asset Assumptions](#))



Use prescribed current and long term gross asset spreads over Treasuries for year 1 and years 4 and after, respectively, with yearly grading in between from tables

Use prescribed current and long-term interest rate swap spread curves for year 1 and years 4 and after, respectively, with yearly grading in between

Use spreads consistent with, and results in reasonable relationships to, the prescribed spreads for public noncallable corporate bonds and interest rate swaps

The model investment strategy and/or any nonprescribed asset spreads shall be adjusted as necessary so that the minimum reserve is not less than would be obtained by substituting an alternative investment strategy in which all fixed income reinvestment assets are public noncallable corporate bonds with gross asset spreads, asset default costs, and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 and 50% PBR credit rating 3.

The gray shading represents substeps.

7 Scoping Guide

Referenced flow charts and tables are contained in Chapter 6. Use the [Blue](#) hyperlink to see the chart and use **Alt + Left Arrow** to return where you were before hyperlinking.

A company anticipating a large-scale implementation may wish to carve out scoping as a separate activity. A company anticipating a small-scale implementation may need less distinction. The Guide treats scoping as a separate activity.

In this Guide scoping is defined as the preliminary work to formulate a Road Map. Scoping is subdivided into the following activities or action steps:

Generic Project Considerations

- 1 Form project
- 2 Define scoping activities/Develop scoping goals
- 3 Develop project approach

PBA General Considerations

- 4 Identify business requirements and financial reporting requirements
- 5 Assemble view of current framework
- 6 Form view of future PBA framework
- 7 Evaluate the current versus PBA framework
- 8 Develop Road Map Project Team requirements

Scoping is intended to be preliminary, tentative, and/or skeletal in nature. It is not intended to be thorough, exhaustive, or comprehensive. Scoping's intent is not to find solutions but to identify and get one's arms around key issues. Scoping is a 30,000-foot exercise, and a company can dial the scoping exercise up or down. Road mapping provides the opportunity to ask and answer more substantive questions and develop and assess alternatives. Early steps in road mapping include identifying and assembling more detailed information and developing project goals.

Although this Scoping Guide provides many considerations the intent is not to paralyze the scoping process by implying that a company should address all considerations or that all considerations have equal importance. The intent is that the user scans and quickly determines whether a consideration does or does not apply.

The scoping stage is related to the Delphi Oracle's maxim "know thy self." Scoping activities primarily consist of getting to know thy current self and thy future self. Each scoping activity below has an introduction followed by considerations.

7.1 Product Applicability and Decision Tree

For which products will NPR, DR, and SR need to be calculated? Will the SET and DET be passed? The answers significantly alter your VM-20 requirements and hence work efforts. Flow Chart 6.1 provides a [product decision tree](#). [Potential reserve applicability](#) and likely answers are

in Table 6.2. However, knowing what applies to most or some products is not the same as knowing the answers and results for a single product—your company’s product. For Level Term products the chances of failing the SET increase with the level period; that is, 20- and 30-year level products are more likely to fail than 10-year products. Features such as inflation-indexed benefits also affect SET results.

The SR, DR, and SET entail projecting cash flows including but not limited to future gross premiums and other applicable revenue, benefits, expenses excluding federal income taxes, net policy loan cash flows (if modeled), reinsurance cash flows, net cash flows to/from the general account and separate account, revenue sharing, and future derivative liability program net cash flows. Projected cash flows reflect nonguaranteed elements, policyholder behavior, company practices, and actions dynamically responsive to the scenarios as appropriate and use Model Segments consistent with asset segmentation.

7.2 Generic Project Considerations

The generic considerations Steps 1–3 are included in the Guide for completeness and are peripheral to the primary PBA considerations.

7.2.1 Step 1: Form Project

Each company has established policies in initiating projects such as a project sponsor, project management, etc. We suggest companies follow what has worked successfully for them on similar projects but be flexible regarding different approaches. PBA Implementation will have many moving targets that project management will need to reflect.

Step 1 Considerations

- 1.1. What will the project approach be?
- 1.2. Will it involve a Steering Committee?
- 1.3. Will it require large commitments from other departments or be fairly confined to Actuarial with support/coordination from other departments?
- 1.4. Specifically, what will IT’s role be in steering and/or supporting the project?
- 1.5. How will it be the same or different than other company/actuarial projects (for example, conversions, Model Audit Rule, or acquisitions)?
- 1.6. What will be the degree of centralization versus decentralization?
- 1.7. Will it involve all Actuarial areas?
- 1.8. When does the Chief Actuary involve other actuaries, Risk Management, or senior management?
- 1.9. What will be the degree of involvement of interested parties?
- 1.10. How will the project be tracked and evaluated? Progress? Time? Resources?
- 1.11. When and how should a scoping team be formed?

7.2.2 Step 2: Define Scoping Activities/Develop Scoping Goals

This may seem circular since this Guide defines the scoping activities. However, each company should adapt the Guide to their needs and develop their own definitions.

Step 2 Considerations

- 2.1. Are scoping and road mapping activities two distinct activities or two phases of the same activity?
- 2.2. What will be the breadth and depth of scoping versus road mapping activities?
- 2.3. What are the scoping objectives and milestones?
- 2.4. What are the planning activities?
- 2.5. What is the scoping timeline?
- 2.6. Who will be on the scoping Team?
- 2.7. When will scoping activities occur? Frequency? Duration?

7.2.3 Step 3: Develop Project Approach

A decision-making model regarding how to engage team members may be useful. The [Vroom-Yetton-Jago Model](#) is provided in Appendix A.2. The model enables leaders to examine situations to determine which of five styles/levels of involvement to engage associates based on seven questions regarding decision quality, commitment, problem information, and decision acceptance.

Step 3 Considerations

- 3.1. How and when will a Scoping Team, Road Map Team, and implementation plan be formed? Will the team initially be a formal or informal group? Size? Subteams for a specific issue? Actuarial only or also IT or Financial/Risk Management/Accounting?
- 3.2. How and when will initial team members be deployed? Additional team members?
- 3.3. Will any team members be dedicated to the project full time? For extended periods? For some periods? During off periods (i.e., times other than quarter-end or budgeting or asset adequacy season)?
- 3.4. Which method(s) will be used? Are various methods with descriptive names such as Waterfall, Agile, Wave, or Surge more appropriate for different parts and phases of the projects?
- 3.5. What will be the project communication process (downward, upward, and/or horizontal)?
- 3.6. What will be the decision-making style?
- 3.7. Which areas need optimal versus satisfactory outcomes?
- 3.8. How will decision information be gathered?
- 3.9. How will alternatives be evaluated?
- 3.10. Who should decide? What will be the degree of individual versus group decision making?

7.3 PBA General Considerations

Step 4 consists of specifying and describing requirements. Steps 5–7 perform gap analysis from a 30,000-foot perspective by evaluating the current framework versus a view of the future PBA framework and then assigning grades. Step 5 looks at the current framework. Step 6 forms a precursory view of the future PBA framework based on the requirements developed in Step 4. Step 7 uses Step 5 and Step 6 to complete a Self-Assessment qualitative report card. Companies can dial up or down the amount of time, level of detail, and attention devoted to Steps 5–7. Companies can perform the steps simultaneously or in any order.

7.3.1 Step 4: Identify Business and Financial Reporting Requirements

Requirements can be framed in several dimensions. The industry will have a vast spectrum of requirements. Requirements will factor into decisions such as [Day-1 versus Day-2 versus Day-3](#) deliverables, the degree of capabilities, and the priority, sequencing, and pace of implementation activities.

Important factors include the relative importance of statutory earnings (versus GAAP or IFRS), the financial close schedule and the use of financial and modeling information and its required accuracy and granularity. For example:

Company A: Statutory reporting is king and “A” only reports on a statutory basis. Statutory earnings are the important metric in bonuses and management compensation. Statutory results and forecasts are heavily relied upon to plan and make business decisions. So demands on accuracy and granularity of forecasts and attribution analysis are high. The capabilities to interpret, to explain statutory results and drivers, and to have management’s confidence are essential. PBA will significantly impact product offerings and development.

Company B: GAAP reporting is king, and GAAP earnings are the important factor in compensation. Management views statutory capital as a constraint in that RBC (statutory Risk-Based Capital) is sufficient for desired financial ratings. “B” has taken the view that PBA is a compliance exercise. The ability to interpret or explain statutory results are not supported or part of the business plan or decision-making processes. PBA will minimally impact product offerings and development.

Company C/D: “C” closes financials by Business Day 5, and “D” closes by Business Day 35.

Company E/F/G/H: “E” intends to implement PBA as soon as possible for reserve relief on term products. “F” intends to implement PBA as late as possible. “G” intends to be excluded from the stochastic and deterministic methods. “H” expects to calculate the stochastic reserves.

Five Stages

The spectrum of using and incorporating information or business intelligence in decision making is categorized into five stages:

- 1 Acquisition
- 2 Delivery
- 3 Acceptance

- 4 Interpretation
- 5 Implementation

Information or intelligence can be framed in the context of what has transpired and/or the future (actual versus forecast). The applicable business purposes may range from producing technically correct financial statements to planning to evaluating acquisitions to developing products to evaluating reinsurance proposals to evaluating investment strategies to managing in force business. The five stages are translated into financial reporting and modeling capability requirements as follows:

Five Stages of Financial Reporting and Modeling

1 Acquisition

- Able to meet PBA technical requirements and calculate financial results correctly
- Able to comply with financial, internal control, and technical standards
- Able to project financial planning results correctly (for one set of business forecast assumptions)
- Able to evaluate multiple alternatives to improve performance and results

2 Delivery

- Able to deliver PBA financial information timely in the desired content and format

3 Acceptance

- Able to have financial information and intelligence accepted (through analysis, governance, audits, controls, track record, communication); that is, management has confidence in the intelligence

4 Interpretation

- Able to interpret intelligence in terms of business objectives
- Able to explain drivers of PBA results and/or forecasts and variances
- Able to evaluate alternatives within a PBA framework
- Able to frame trade-offs between growth, earnings, and risk/capital

5 Implementation

- Able to use financial intelligence to make decisions, take actions and execute
- Able to develop products within a PBA framework
- Able to manage risks within a PBA framework

Company “A” is likely to want to be in Stage 5 on [Day-1](#) and to be able to incorporate statutory information into decisions. Company “B” will likely never get past Stage 3, wanting only to comply with technical and governance requirements.

Step 4 Considerations

- 4.1. How is company performance measured? Incentives/bonuses? What accounting bases? Earnings? Capital?

- 4.2. Which of five stages of financial reporting and modeling capabilities will be required?
What will be the “quality,” “cost,” and “benefit” requirements of these capabilities?
When will these capabilities be required? All at once? Evolving? At what level?
- 4.3. How long will capabilities and systems be needed in order to “play and test drive” before going “live” at any of the five stages.
- 4.4. What are/will be the statutory financial information requirements to support management?
Monthly/quarterly/annually/other
Reporting close process time
Forecasting close process time
Granularity (reporting levels and components), accuracy, explanations, insights, auditability
- 4.5. How will PBA be integrated with other business requirements? For example:
Internal controls
Model Audit Rule
Materiality standards
Documentation standards
Regulatory requirements
Business continuity and disaster recovery requirements
Governance
Internal and external audiences
How will PBA be integrated with other business initiatives?
- 4.6. Will PBA change:
Requirements?
Measurements?
Product development criteria and activities?
Enterprise risk management activities?
Financial information requirements?
Close schedule? During initial company adoption? Long term?
How will an increase in the volatility of statutory earnings be viewed? By management? The board? Investors? Analysts?
What will be the requirements on current products, future products, product cycles, and competitive landscape?
- 4.7. Will the company leverage investments made in implementing PBA and developing capabilities to broader business contexts?
- 4.8. How is financial information integrated and used in decision making?
- 4.9. Will PBA capabilities be used for other business purposes (other than reporting results)?
- 4.10. How will the actuarial functions and responsibilities be structured and coordinated?
How will resources be shared?
- 4.11. What new requirements will there be? Financial statement content? Disclosure? Data?
- 4.12. What resources, skills and expertise will be needed?
Interpreting requirements
Designing
Building

Testing
Documenting
Operating
Interpreting

- 4.13. How will statutory and PBA requirements be related to other requirements such as GAAP and potential IASB/FASB accounting changes?
- 4.14. How will implementing and operating PBA affect people?
- 4.15. When will PBA be effective? What are the immediate regulatory requirements (submission of data)? What will the tax implications be? When will the company adopt PBA for each of its blocks?

7.3.2 Step 5: Assemble View of Current Framework

Step 5 might entail getting the right people together or it might entail obtaining the required information from documents or some combination thereof. The level of information during the scoping stage does not need to be overly detailed. The type of information depends on how a company chooses to know and grade “thy self.” Less can be better. The road mapping stage will identify if and where more may be needed.

Step 5 Considerations

For Step 7 ([Self-Assessment Evaluation Report Card](#)) the following information on financial reporting and cash flow testing environments could be needed/useful:

- 5.1. Actuarial Structure: Functionalities, Responsibilities, Staff Size, Competencies, Culture
- 5.2. Assumption setting
 - Experience Studies
 - Margins
 - Company philosophy on setting margins
 - Frequency
 - Scenarios—where and how are scenarios generated?
- 5.3. Inputs
 - Number of administrative systems (Direct, Reinsurance, Investment)
 - Quality (missing/poor/automated) of administrative data and accounting inputs
 - What is off-system (content and magnitude)
 - Market data and inputs
- 5.4. Model Platforms (Throughputs)
 - Number, usage, and capabilities of liability platforms
 - Number, usage, and capabilities of asset platforms
 - To what degree are assets and liabilities integrated?
 - What is off-system (content and magnitude)
- 5.5. Outputs
 - What, how and where are reports, analytics, and other output stored, calculated, and generated?
 - How many separate/distinct processes and repositories?
 - How, when, and where is it consolidated/aggregated?

- Which platforms: Excel, Access, data warehouses
- 5.6. Systems—Hardware
 - What is run on desktops, servers, grids, clouds, etc.?
- 5.7. Close calendar (schedule)
 - Tasks—workflows
 - Major to/from deliverables
 - Run time versus Processing time versus Analysis time—input, throughput, output stages
 - Competency levels of staff performing tasks
- 5.8. Governance—a qualitative assessment
 - Model governance/Technology governance (application—access, security, installation, change control, etc.)
 - Input and Output governance
 - Assumption governance
- 5.9. Internal/External Audit/Regulator
 - Effort and resources to support audit and regulatory requirements
- 5.10. Documentation and knowledge management
 - Capability to create and transfer documentation and knowledge regarding inputs, outputs, results, justifications, explanations, validations, demonstrations, assumption setting, etc.
- 5.11. Resources
 - Run time versus Processing time versus Analysis time for input, throughput, output stages
 - Manpower and calendar time for the above activities—close, governance, experience studies, audit, documentation

7.3.3 Step 6: Form View of Future PBA Framework

To conduct Step 6, subject matter expertise on VM details is not required. However, understanding the manual from an Executive Summary perspective is. Step 6 requires the ability to translate a high-level understanding of the VM and the requirements developed in Step 4 into high-level implementation and operational requirements and functionality. A more detailed view of the future PBA framework and considerations are outlined in the Road Map Guide.

[Flow chart 6.4: PBA Operational Flows](#) provides a view of a future PBA framework sufficiently high level as to be adaptable by small and large companies alike. It is also adaptable for the FASB's Insurance Contracts Exposure Draft. The framework could represent a single modeling platform or multiple platforms. Each shape could represent one or more model or repository. A single arrow or shape might represent numerous intermediate processes. Each arrow represents multiple uses (such as reporting, forecasting, pricing, cash flow testing) and also embodies controls, governance, and other attributes related to the flow/task. A flow into a repository may bypass the repository and flow directly to the next flow chart shape. Finally the

flow of activities is not necessarily time continuous. For example, assumption setting could occur during off-close and be stored for later use.

Considerations

Below are considerations for a future PBA framework. A simple view is that operating under PBA will be like operating a modified version of cash flow testing while meeting statutory financial reporting requirements such as schedule, granularity, and accuracy.

Assumption Setting

Assumption setting and supporting experience studies need to be updated regularly. Margins need to be determined on most assumptions. The granularity and level of assumptions and margins utilizes company experience and industry experience and is prescribed or relies on judgment. The mortality assumption and margin is a significant factor in the level of deterministic and stochastic reserves. High-quality and credible data positively affect assumptions, margins, and reserves.

Input

The future PBA framework will require appropriate data content and/or level of granularity to support model in force inventories and assumption setting. Inventory data elements need to support the projection of model cash flows. Input data management needs to support the desired data content, quality, credibility, and granularity for setting assumptions. The process to capture, store, manage, stage, and control data needs to be robust and flexible.

Models and Throughput

Three reserves need to be calculated—a Net Premium Reserve (NPR), a Deterministic Reserve (DR), and a Stochastic Reserve (SR)—and a Deferred Premium Asset (DPA). The minimum reserve (under PBA) is the maximum of the three quantities:

$$\text{Max}(\text{NPR}, \text{DR} + \text{DPA}, \text{SR} + \text{DPA}).$$

Under some conditions exclusions from calculating SR and DR are permitted. If the exclusions are satisfied, models are still needed; however, the requirements of frequency, timeliness, and ability to explain are virtually removed.

The NPR calculations are similar to the existing CRVM with some differences such as the calculation of expense allowances and the inclusion of lapses. The more substantial model requirements arise from the DR and SR calculations. The model needs to project cash flows such as premiums, benefits, expenses, and investment income including policy loans, substandard benefits, riders and supplemental benefits, assumed and ceded reinsurance, and hedging/derivative programs. The projection is on a single deterministic scenario for DR and a set of stochastic scenarios for the SR.

Some of the cash flow components will be modeled or calculated differently either due to a method being prescribed or having limits such as the average credit rating of a reinvestment

strategy or requirements such as the amount of starting assets, which may need iterations to determine. Depending on your Step 4 requirements more robust and dynamic assumptions and methods may be needed in the areas of policyholder behavior and company actions (e.g., investment strategies) since the results directly and immediately impact the financial statement. The assumptions and models might need to support different business purposes at different times (e.g., reporting, pricing, risk management). Forecasting the future values of SR or DR at $time = n$ may require stochastic on stochastic capabilities.

Models will need to be updated more regularly. Models will need to be run multiple times either during the financial close or the off-close periods. Runs could be needed to:

- Quantify the impact of margins
- Determine/iterate for the required started assets
- Perform attribution analysis
- Quantify the impact of assumption changes
- Quantify assumption sensitivity
- Quantify/demonstrate the impact of model compressions, approximations and simplifications.

Technology

Faster processing will be needed. How much depends on Step 4 requirements. Processing includes model run times and also includes input and output processing times. Supporting technology such as distributed processing, memory, and data storage will be needed.

Output

A tremendous amount of output data will be produced. Output will need to be validated, analyzed, and explained. The collection, storage, governance, and management of output data are needed.

For companies with more than \$50 million in direct premiums, the experience reporting submission requirements to regulators **begin upon the effective date without a transition period.**

Governance

VM-G is not intended to create new duties for the Appointed Actuary, senior management, or the board of directors but rather emphasize and clarify their roles and responsibilities. The board is responsible for implementing controls around the models, understanding the product risks identified, understanding VM-20 reserves in relation to overall company risks, and supporting senior management's oversight role. Senior management is responsible for overseeing the VM-20 valuation function, for ensuring an adequate infrastructure such that policies, procedures, controls, and risk tolerances are operational, for reviewing valuation components including models, assumptions, and methods, and for reporting to the board valuation results, critical risk elements, effectiveness of controls, and risk management strategies. The Qualified Actuary is responsible for reviewing and approving models, methods, and assumptions and providing a summary report to senior management and board. The Appointed Actuary is responsible for opining on all reserves—both formula-based and PBA VM-

20 reserves and for disclosing to regulators and external auditors any significant unresolved issues related to VM-20.

Organization

Implementing and operating PBA will be a force of change. The change may be minimal or may potentially result in a large disruption or displacement. Some people are more or less tolerant of change than others. There could be a wide spectrum of reception or resistance to changes. There will be many new things to learn. Under PBA different skill sets will be perceived or recognized as more or less valuable. More valuable skill sets include the ability to:

- Build, maintain, validate, and operate models
- Analyze, interpret, and explain (deterministic and/or stochastic) results
- Explain more volatile earnings to management
- Evaluate alternatives and recommend actions to management

Other

Implementing and operating PBA will impact many departments and potentially communications to the board and external audiences. The degree of impact depends on your Step 4 requirements. This is to some extent implicit in each of the above considerations. For example, what will be the model and output capabilities needed by product development or by risk management?

7.3.4 Step 7: Evaluate the Current versus PBA Framework

A simple evaluation criteria is to ask, if your cash flow testing had to meet the same timeline as current statutory reporting and other demands such as governance, audits, and explanations, what would break? What does it take to make it work? [Table 6.5: Self-Assessment Evaluation Report Card](#) is a template to evaluate your current framework versus your desired future PBA framework.

Self-Assessment Evaluation Report Card Instructions/Considerations

Grades should be assigned versus the requirements in Steps 4 and 6 such as desired capabilities to explain PBA results for the quarter (versus forecast), to project PBA reserves for business planning, and to reflect PBA in product development and pricing and in risk management.

A grade of NA means it is not applicable (i.e., present). For example, generating scenarios for the term block would be NA in statutory financial reporting but receive a letter grade in cash flow testing. Grades could be based on an internal standard and the degree to which meeting requirements is enabled/inhibited. Grades could also be based on comparisons relative to the industry or a peer group.

Evaluation should not only consider whether a calculation/task/process *can* be done but *how*. How can be measured in resource cost—time, software, hardware, people, skill levels, manpower—and opportunity and information cost.

Magnitude and resources should reflect the existing gap and the effort and time to interpret valuation manual requirements and make choices and to build, validate, and understand methods and results.

A side result in assigning grades and scores is to identify strengths and weaknesses in:

- The financial close
- Cash flow testing/modeling
- Product development
- Risk management
- Related activities (experience studies)

A weak/strong process or component can still possess some strong/weak subprocesses or subcomponents.

Grades and Scores

See 6.6 [Self-Assessment Evaluation Report Card](#) for the template to assign grades/scores. The template uses letter grades for the quality of the current/future frameworks and numerical scores to reflect a quantitative perspective.

Columns 1–2: Grade of Current Framework

Assign a grade (A/B/C/D/E/NA) to each row for the current framework Financial Reporting (FR) and Cash Flow Testing (CFT) to meet the future PBA framework.

Columns 3–4: Magnitude of Change

Assign a score (1–10/minimal–significant) to each row for the magnitude of change required to convert the current FR or CFT frameworks to the future PBA framework.

Columns 5–6: Resources for Change

Assign a score (1–10/minimal–significant) to each row for the required resources to implement the changes from the current FR or CFT frameworks to the future PBA framework and to operate the future PBA framework.

Column 7: Importance

Assign a score (1–10/low–high) to each row for its importance in meeting the requirements.

Column 8: Desired Grade of Future Framework

Assign a grade (A/B/C/D/E/NA) to each row that is desired for the future PBA framework. You may wish to assign two grades: a grade for Day-1 and for Day-2 if they differ.

7.3.5 Step 8: Develop Road Map Team

First general project considerations are provided followed by PBA considerations.

Step 8 General Considerations

- 8.1. Departments involved in the project and degree of involvement
Actuarial, Financial, Accounting, Investments, IT, Audit
- 8.2. Roles and Responsibilities
- 8.3. Project Governance: Enterprise versus Departmental, Steering Committee, Project Leader, Project Manager, Project Team(s), Primary versus Support/Advisory team members
- 8.4. Team formation
 - Leadership
 - Functional—project, advisory
 - Composition—who, what (skills, ability, knowledge), size, personality, specialization
 - Structure and roles (for example: coordinator, architect, builder, technician, subject matter expert, thought leader, gatekeeper, evaluator)
 - Task structure
 - Selection
 - Focus effort—percentage of work time members devote to project during various phases and tasks
- 8.5. Team processes
 - Cohesion, Conflict, Communication
- 8.6. Team development—initial and throughout entire project
- 8.7. Management support
- 8.8. Support systems
 - Technology, information systems, training, rewards
- 8.9. Culture
- 8.10. Change tolerance

Step 8 PBA Considerations

- 8.11. How many staff will be the subject matter experts on all or designated parts of Valuation Manual at various stages of the implementation? Once PBA is operational?
- 8.12. How and when will company gain expertise and make interpretations of specific requirements?

8 Road Map Guide

The Road Map Guide follows the same structure as the Self-Assessment Evaluation Report Card and has the following sections:

Introduction

- 1 Assumption Setting
- 2 Inputs
- 3 Model Platforms (Throughputs)
- 4 Outputs
- 5 Technology and Systems
- 6 Actuarial Organization
- 7 Potential Road Map Initiatives

Introduction

Developing a Road Map entails exploring alternatives and evaluating and implementing competencies, capabilities, activities, and processes that could collectively be called practices. Practices across industries and within the insurance industry and within the actuarial function vary greatly. Some practices are labeled “best,” “advanced,” “cutting-edge,” or “leading.” The connotation is that one should be striving toward and adopting leading/best practices. That could be a misguided goal depending on how narrow or broad one views or applies practices.

Practices should be aligned with company strategy. For example, five business-level strategies are cost leadership, differentiation, focused cost leadership, focused differentiation, and integrated cost leadership/differentiation. Another label is “right”: the right practices. The right capabilities, activities, and processes including actuarial practices are not identical across all strategies. For example, the actuarial product development function at a company following a differentiated strategy will continually be introducing new and innovative products with many differentiating features and services. A cost leadership company will not. The competencies and leading practices to support these two strategies have similarities but have important distinctions.

Leading practices in a future PBA framework are explored in four areas:

- 1 Capability: Can and How
- 2 Automation
- 3 Centralization
- 4 Robust and Flexible

These four interrelated areas are all critical to operating a PBA framework. Addressing gaps and deficiencies will be integral components of any Road Map. The considerations are to what extent, when, and how a company should implement capabilities, full automation, a centralized input database, model or output database, and fully flexible and robust infrastructures. A question is: Is more always better, and is most/all always best?

Capability: Can and How

One question to ask is: “Can we/it do XYZ?” For example, can we calculate the prescribed mortality assumption? Can the system calculate sensitivities? Can we quantify the impact of a margin? “Can” is necessary for the first of the [five stages](#) of intelligence—technically correct PBA results. A second question is, “How do we/it do XYZ?” How something—a calculation, a task, a process, a validation, analysis, and a control—is done is critical. *How* translates into productivity, bandwidth (i.e., how much can be done before it breaks), can you do it many times, and cost (how much resource in time, people, things to implement, operate, and maintain). *How* affects if PBA is operationally effective and supports company strategy.

Automation

Automation will be essential in implementing PBA. More automation has benefits and advantages, such as facilitating controls, reducing labor costs, allowing more time for analysis and fostering capability, sustainability, and consistency. However, automation is not a panacea, especially if done poorly or not selectively. Automating a process could simply result in producing existing mistakes faster with less transparency at higher costs. If the automated process is complex and consists of many steps, it can be difficult to maintain and operate and validate. Updating the automated process for new products, reinsurance treaties, changes in input granularity, changes in methods, administration system changes, and changes in business needs to analyze and interpret results can all have unintended consequences.

A principle is the significance, number of times the step(s) must be performed, and total number of steps in the process. For example consider a semiautomated semimanual process that is acceptable now because it is low cost and meets business requirements. Suppose the process is performed only once during a financial close and consists of only a few manual interventions. Implementing and maintaining full automation for this process have high costs and little benefit. If it continues to be performed once in the PBA framework it is likely to continue to be considered acceptable for all the current reasons. However, if the process is performed dozens or hundreds of times in a PBA reporting cycle, the costs to retain the current manual process could be astronomical or cripple the ability to meet PBA requirements. Likewise, one manual step may be acceptable, but a sequence of many manual steps may not be.

Centralization

Centralization will also be important in implementing PBA. Multiple input sources, databases, platforms, repositories, models, processes, and studies can overwhelm and cripple operations in a PBA world. Each piece must be understood (user expertise), built, maintained, and controlled. In this case, less has its benefits and advantages. Lack of centralization can inhibit automation. Benefits of streamlining and centralization include facilitating automation, production environments and controls, reducing redundancies, and fostering capability, sustainability, and consistency. However, attaining full centralization is high in execution risk and can incur considerable cost, effort, and time to build, reconcile, and utilize.

Interdependencies create challenges to understand, to implement, and to maintain without creating side effects of unintended consequences.

Robust and Flexible

Robust and flexible are both instrumental qualities in a PBA world. Systems and processes such as experience studies, models, reporting tools, and controls need to be robust to support the breadth, variety, and volume of PBA demands. However, being robust is desirable up to a point, possibly collapsing from its own weight. Robust runs the risk of what for software applications is called *bloatware* or *creeping featuritis*, resulting in conflicts with other applications, wasted resources such as memory, storage space, and speed, increased resources to train, operate, and maintain, and inhibiting user understanding of an overly complex process. In the extreme, it may result in a never-ending never-reached goal.

Flexibility is even more necessary in a PBA world and in an economic and business environment with ever increasing and accelerating changes. Flexibility can overcome shortcomings in robustness, reduce costs to operate and maintain processes, enhance speed and responsiveness, and facilitate exploiting strengths and pursuing business opportunities. Flexibility also supports incremental improvements in capabilities, automation, and centralization. However, flexibility in the extreme may be costly to obtain and may be a drag on performance.

Practices: Summary

The degree of capabilities, automation, centralization, robustness, and flexibility as well as the magnitude and resources to implement and maintain will vary according to a company's strategies and requirements. What is right for one company may not be feasible, affordable, attainable, or right for another company. Finding the right balance can enable or paralyze PBA implementation or operational efforts. So too will focusing on the important things instead of everything. Instead of pursuing large initiatives that only have payoffs at the end or after a long period of time, we recommend an approach that allows continual and incremental improvements in all four areas applied to all PBA aspects over an extended period of time. The remaining Road Map sections will guide users in assessing, choosing and targeting the what, how, how much, and when that is right for them.

8.1 Assumption Setting

We recommend an "A" for Assumptions in your future PBA framework no matter what your business requirements (per [Scoping Guide Step 4](#)). Whichever end of the spectrum in the [five stages](#) of using intelligence, from technically correct to fully implemented in strategic and tactical decision making, the benefits of an "A" and the downsides of a "B" are many. What earns an "A" depends on the requirements.

Assumptions with and without margins must both be managed. They need to be updated regularly. Some prescribed assumptions such as mortality and investment assumptions entail many steps. Many different sets assumptions will be used by multiple users, functions, and business purposes spanning multiple reporting periods. Different applications may use different levels of granularity. Margins are related directly or indirectly to the quality and credibility of data and analysis, for example, experience studies. Margins directly impact the level of deterministic and stochastic reserves.

Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework, Section 4, introduces different methods for establishing margins. Section 5 considers different approaches to determine margins for specific assumptions such as expenses, expense inflation, policyholder behavior, and reinsurance. The *ASOP PBR Draft* states, “The actuary should be particularly careful about the level of granularity in the premium assumptions ... should consider the desirability of making multiple premium payment assumptions, by subdividing the cell of business into several projection cells.”

VM-31 has substantial documentation and disclosure requirements including descriptions of the assumptions, margins, and methods to develop them, significant changes in the methods from the prior year, valuation assumptions that differ from those in other risk analyses, and at least every three years an actual to expected analysis. VM-31 requires quantification of the impact of individual margins on the deterministic reserve for each risk factor(s) that has a material impact and the aggregate impact of all margins and an explanation of impact of sensitivity tests in developing assumptions. Assumption granularity reflects balancing the challenges in disclosing, managing, reviewing, validating, and updating assumptions.

Consider the decision-making intelligence [five stages](#) (Scoping Guide Step 4). Acquiring or complying with the technical requirements in setting, reviewing, and updating assumptions, calculating the NPR, ET, DR, and SR correctly, and quantifying impacts of margins and sensitivity tests depends directly on assumptions. The timely delivery of PBA financial information in the desired content and format for VM-31 compliance or for management information would benefit from a robust assumption platform. Accepting and interpreting financial results and business plans and implementing that intelligence into decision making is directly related to understanding the effect and impact changes in assumptions and variances in emerging experience.

All these considerations place demands and stress on the management of assumptions. Assumption management and governance will depend on the desired production and control environment.

A Survey of Actuarial Modeling Controls in the Context of a Model-Based Valuation Framework stated, “In follow-up discussions, a few companies indicated that they were in the process of building a centralized model assumption repository. Each company that was engaged in this type of project expected it to be a lengthy and complex process, as there can be hundreds of assumptions involved. There are also considerations for how the centralized assumption repository is updated and how assumptions are fed from the database to different models.”

Net Premium Reserve (NPR) Assumptions

(See [Road Map Guide Model Platform NPR](#).) Mortality Rates (VM-20 3.C.1) are the same as current, that is, 2001 CSO, except that new valuation tables adopted in the future would apply to all business issued since the adoption of the VM (and not since the adoption of the table). Interest Rates (3.C.2) use a formula similar to the current prescribed formula with a few changes such as introducing differentiation between products with nonforfeiture benefits

provided or not provided and fund-based products with secondary guarantees (SG). Interest rates are locked in for calendar year of issues.

Lapse rates are introduced for some products. Non-fund-based products providing nonforfeiture benefits and fund-based products with no SG or $SG \leq 5$ years use 0% lapse rates. Nonfund-based product lapse rates (i.e., Term) vary according to the length of initial level and subsequent renewal premium periods and the percentage increase in the guaranteed gross premium at the end of the initial level period. These lapse rates are fixed and determined by product guarantee, that is, set at policy issue. Lapse rates for fund-based products with $SG > 5$ years vary according to policy values as of the valuation date as well as projected values.

NPR uses **guaranteed gross premiums** not current premiums to determine assumptions

Stochastic Reserve (SR) and Deterministic Reserve (DR) Assumptions

Assumptions are either prescribed, stochastically modeled or use prudent estimate assumptions applying a margin to provide for adverse deviations and estimation error. Assumptions must be periodically reviewed and updated as appropriate. Sensitivity testing of assumptions is required to understand the materiality of prudent estimate assumptions on the minimum reserve. For SR, interest rates and equity performance are stochastically modeled. The hierarchy for setting assumptions is outlined in VM-20 9.A:

- 1) Use own experience, if relevant and credible
- 2) Combine relevant company experience with industry experience data or other applicable data consistent with credibility theory and accepted actuarial practice
- 3) Use other available relevant experience consistent with accepted actuarial practice and
- 4) Use the most relevant data available using sound actuarial judgment.

Prescribed assumptions are mortality and asset defaults. Some nonprescribed assumptions have constraints such as expenses and investment strategies.

Margins must **increase** the minimum reserve.

Mortality

See [Flow Chart 6.11: Stochastic and Deterministic Reserve Mortality Assumption](#). Mortality is prescribed and complicated. A simplistic overview is credibility weighted company experience graded to industry basic tables. It entails mortality segments potentially subdivided into subclasses, an Underwriting Criteria Score that may be adjusted, prescribed margins and procedures to blend to industry tables based on credibility levels, and a number of other factors. Adjustments are allowed for impaired lives or policyholder behavior. Mortality improvement may be included up to the valuation date but not beyond the valuation date. Granularity of mortality segments are determined by the company. It should be stressed that the margins vary significantly based on the credibility level and that margins have a material impact on the SR and DR reserves.

Policyholder Behavior Assumptions

Policyholder behavior assumptions are modeled dynamically or in other scenario-dependent ways to reflect anticipated policyholder behavior relative to characteristics at an appropriate level of granularity with margins reflecting uncertainty, policyholder efficiency, and degree data are relevant or credible. Level Term products with a material premium increase must adjust the lapse and mortality assumptions. Required sensitivity testing at a minimum includes premium payment patterns, premium persistency, surrenders, partial withdrawals, allocations between available investment and crediting options, benefit utilization, and other option elections if relevant to the risks in the product.

Expenses

Expense assumptions use fully allocated expenses using a consistent method across company lines of business, reflect the impact of inflation, exclude future expense improvements, exclude federal income taxes, and include margins. Expense assumptions for the deterministic and stochastic scenarios are the same except for differences from inflation rates.

Asset Assumptions

(See [Flow Chart 6.12: Stochastic and Deterministic Reserve Asset Default Assumption](#).) Asset default costs are prescribed and complicated. Assumption development uses the asset's PBR credit rating (a 21-class system), weighted average life on the valuation date and two factors that grade linearly over four years to zero: a spread-related factor applied at the individual asset level and a maximum net spread adjustment factor applied as a portfolio-wide upward default adjustment. (See [Flow Chart 6.13: Stochastic and Deterministic Reserve Asset Gross Spread Assumption](#).) VM-20 prescribes a procedure for setting prescribed gross asset spreads by projection year, investment expenses, embedded options, revenue sharing, interest maintenance reserve on a pretax basis (PIMR), modeling of derivative programs, and constraints on the investment strategy.

Discount Rates

The method to determine discount rates is prescribed. The discount rates for each model segment in the deterministic reserve calculation are the path of net asset earned rates. Details regarding the order and timing of calculations are left to interpretation. The discount rates for each model segment within each scenario in the stochastic reserve calculation are the path of one-year U.S. Treasury interest rates in effect at the beginning of each projection year multiplied by 1.05.

Scenarios

For the SR, VM-20 requires scenarios be generated by the Academy's economic scenario generator with certain prescribed parameters. The SERT consists of 16 prescribed deterministic scenarios.

Exclusion Test Assumptions

The Stochastic Exclusion Test (SET) may be passed using one of three methods: a Ratio Test, a Demonstration Test, or a Certification.

Stochastic Exclusion Ratio Test (SERT)

(See [Flow Chart 6.6: Stochastic Exclusion Ratio Test](#) and [Road Map Guide Model Platforms SERT](#).) SERT consists of calculating an adjusted deterministic reserve on a group of policies for each of the 16 scenarios that is equal to the deterministic reserve with some exceptions such as no margins are applied and contract types with significantly different risk profiles may not be grouped together for purposes of calculating the exclusion ratio. The denominator of the ratio uses the baseline scenario on a direct or assumed basis.

Stochastic Exclusion Demonstration Test

The *Stochastic Exclusion Demonstration Test* allows a company to pass the SET by providing a demonstration in the PBR Actuarial Report in the first year and at least every third calendar year thereafter that with reasonable assurance the stochastic reserve is smaller than the greater of the DR and NPR. VM outlines four acceptable methods, and a company may use another method acceptable to the commissioner. The methods include:

- 1) Demonstrate $SR + DPA < \text{Max}(DR + DPA, NPR)$ for all policies in the group,
- 2) Demonstrate the inequality in (1) is true for each of a sufficient number of adverse deterministic scenarios,
- 3) Demonstrate the inequality in (1) is true using a representative sample of policies or
- 4) Demonstrate that any risk characteristics that would cause the inequality to be false are not present or have been substantially eliminated through actions such as hedging, investment strategy, reinsurance, or passing the risk on to the policyholder by contract provision.

Stochastic Exclusion Test Certification

For groups of policies other than Variable life or Universal Life with a secondary guarantee, in the first year and at least every third calendar year thereafter, the company provides a certification by a Qualified Actuary that the group of policies is not subject to material interest rate risk or asset return volatility risk. A Guidance Note provides three examples of methods a Qualified Actuary could use to support the actuarial certification.

Deterministic Exclusion Test (DET)

(See [Flow Chart 6.7: Deterministic Exclusion Test](#) and [Road Map Guide Assumptions DET](#).) DET consists of comparing the guaranteed gross premiums with valuation net premiums with some requirements such as using the policy's corresponding Net Premium Reserve method but using 0% lapse rates. Contract types with significantly different risk profiles may not be grouped together for purposes of performing the exclusion test.

Considerations

How will PBA Implementation of assumptions affect other actuarial functions?

How will assumptions for PBA reporting be integrated, coordinated with other assumption-setting activities?

When will assumption(s) be set?

Will there be an assumption policy and/or an approval process? Will these be formal and/or involve a committee? Will it fall under Corporate Governance?

How are assumptions and margins stored, accessed, implemented, and changed?

Review assumptions used in pricing, planning, GAAP/IFRS reporting, cash flow testing (asset adequacy), and risk management.

Will there be an assumption steward?

How much time will be needed to: explore alternatives and methods and build repositories, calculation programs and processes? Understand the impact of the level of assumptions and margins? Understand the impact of changing assumptions (i.e., the volatility in earnings due to unlocking/updating assumptions)? Understand the impact on pricing and risk management?

What can be automated? How can IT support automation?

To develop and evaluate alternatives consider a closer examination of the Scoping Guide Report Card grades and scores assigned to Assumption Setting.

Experience Studies

Centralization versus Silo (by function)

Adjustments to data

Calculation engines

Content

Granularity

Credibility

Disclosure of analysis

Information and Sources

Company data

Industry information: SOA studies, Moody's default study

Bloomberg, investment managers

Reinsurer experience studies

Judgment: actuarial, asset managers, investment department

Data content, quantity, quality, credibility, and granularity

- Data scrubbing

- Product specific

- Data to support behavioral assumptions such as premium payment, benefit utilization and loan activity

Blending company information with industry information

Processes and Analytical Engines

Process to control, capture, manage, and stage for models

Data repository and interfaces

Experience study calculations

Production and ad hoc studies

Data analytical capabilities

Credibility methods

Blending capabilities
Validation methods
Data interfaces

Setting Assumptions and Margins

Philosophy and methodology in setting assumptions including margins:

- Sources
- Level
- Granularity
- Format
- Mean reversion, grade-in to historical experience
- Dynamic formulas, functions and parameters
- Predictive modeling

Categories: Similarities and differences

- Mortality/morbidity
- Policyholder behavior (dynamic)
- Expenses
- Assets
- Reinsurance
- Nonguaranteed elements/management action
- Counterparty behavior
- Economic financial and market information
- Correlations

Developing knowledge: the sensitivity and impact of assumptions, margins, methods, and granularity on reserves

Emerging experience

- Philosophy: How responsive? Temporary versus permanent? Partial credibility? Grade-in?
- Reduce or introduce volatility?

Assumption Governance and Documentation

Centralization

Steward

Assumption policy

- Formal procedures
- Assumption setting process
- Ownership of assumption-setting process by business purpose, functional area, or accounting/economic basis
- Consistent (neutral) views by function/purpose
- Levels of review/approval
- Sources

- Assumption update/review timing and frequency, storage, location, access, communication

Documentation

Peer Review (internal and/or external)

8.2 Inputs

We recommend targeting specific areas to change, specifically critical pain points. A set of inputs—asset and liability data inventories, assumptions, scenarios, model parameters, product specifications and rates, asset specifications—are not that much different than current CFT inputs. However, holistic PBA demands may necessitate changes in the staging, storage, management, and validation of inputs. Demands for postinput processing (running models, staging output, analysis) may increase pressure to accelerate staging inputs. Investment and expense inputs, especially asset impairments, are often the last inputs available during a financial close.

Inputs needed to support projecting the cash flow elements for SET, DET, SR, and DR include inventory information on base products and riders including substandard and supplemental, assets including IMR on a pretax basis, discrete reinsurance (YRT, Co, ModCo) and aggregate reinsurance (i.e., stop loss, experience refund), policy loans, separate accounts, assets, and related information.

The SR, DR, and SET entail projecting cash flows including but not limited to future gross premiums and other applicable revenue, benefits, expenses excluding federal income taxes, net policy loan cash flows (if modeled), reinsurance cash flows, net cash flows to/from the general account and separate account, revenue sharing, and future derivative liability program net cash flows. Projected cash flows reflect nonguaranteed elements, policyholder behavior, company practices, and actions dynamically responsive to the scenarios as appropriate and use Model Segments consistent with asset segmentation.

VM-20 also requires sensitivities and quantifying impact of margins. This requires managing multiple sets of inputs including assumption and margin sets. The process to stage and run a model—correcting missing data, manual interventions, selecting the appropriate set of assumptions, margins, and sensitivities—may be deemed acceptable for a single realization (i.e., model run). However, the extent that these staging processes would be performed for each realization could pose challenges.

Seriatim models may not meet scheduling requirements. VM-20 states, “A company may use simplifications, approximations and modeling efficiency techniques to calculate the net premium reserve, the deterministic reserve and/or the stochastic reserve.” A VM-20 drafting note indicates “a new Actuarial Standard of Practice (ASOP) for principle-based reserves for life products ... will provide guidance on how to group policies into representative modeling cells, as well as providing guidance on model granularity versus model accuracy.” Considerations in compressing in force liability or asset files or scenarios include the degree to which the process is manual or automated and subjecting the compression rules to governance controls and control validation metrics.

Considerations

All the participants interviewed for the Guide have automated and controlled processes to capture and stage most inputs. Most have manual interventions to populate missing data or

correct data for inventory inputs. All manually enter some assumptions into the model. An example of a manual entry is updating per policy maintenance expenses. These processes are highly procedural with front-end and back-end controls (reviews and validations) and are not resource or time intensive.

Input validation methods in practice include the following:

- a) Two sets of inputs (input files, model settings, etc.) are compared to obtain a complete list of differences to verify what was supposed to change did change; and what was not supposed to change did not.
- b) Peer review of model settings and assumptions
- c) Asset and liability output produced by inputs is validated by cell testing, dynamic validation, and/or other methods (see Output)

With multiple sets of assumptions, margins and sensitivities, one needs to know with certainty which inputs produced which outputs.

An input storage consideration is being able to reproduce results used in financial statements. For stochastic results the method and seeds used in generating random numbers in conjunction with distributed processing creates challenges in reproducing results exactly due to the order of operations.

A database housing inputs may facilitate input management. A central location with multiple files containing inputs may also be acceptable. There are potentially large numbers of input sources. Consideration should be given to automation versus manual processes. Automated interfaces populating the database will need to be managed and controlled. Interfaces will also be needed to extract and map the correct inputs to the correct model fields. Content, format, and organizational structure of inputs will all need to be managed and controlled. Consideration should be given to centralizing all or some inputs.

Input Management

Centralization versus Silo (by function)

Storage

Input Process

Process to control, capture, manage, and stage for models

Adjustments to data

Compression of inventory or scenarios

Input validation (interdependent with Output)

Data repository and interfaces

Validation methods

Input Governance and Documentation

Centralization

Steward

Assumption policy
Formal procedures
Reliance on others
Reproducible
Access
Documentation

Supports business and reporting requirements

Content, quality, and granularity

8.3 Model Platforms (Throughputs)

Introduction

In this Guide a “Model” may represent one to multiple systems, modules, programs, and applications. Thus if one program, module or system adjusts or modifies values that another program, module, or system calculates, the collective calculations is referred to as [model\(s\)](#). A set of software and applications in which the models reside is referred to as [model system\(s\)](#). One example is post-run modifications to make top line adjustments in business planning or to reflect something not modeled in cash flow testing. Another example would be a program or application (e.g., Excel spreadsheet) that has output from several product models (e.g., multiple Term and Traditional blocks) and allocates items input at an aggregated level such as starting DAC Tax, Stop Loss Reinsurance, or the excess of the $\max(\text{SR}, \text{DR}) + \text{DPA}$ over the NPR.

A primary consideration is what changes need to be made to current models and model systems. First, model calculation requirements and considerations are explored. Second, additional model considerations and model system considerations are explored. Model considerations overlap and are interdependent with many other considerations such as Assumptions, Outputs, and Technology. Model systems can range from 100% in-house to 100% vendor to somewhere in between. A significant choice and decision is which systems: the current systems and/or new systems and, if new, whether in-house or vendor. In any case the models will undergo substantial changes.

Calculations

VM-20 requires companies to model and calculate values ranging from the same as current methods to slightly different methods to radically different methods or not previously calculated. What needs to be calculated depends on which of the NPR, SR, DR, SERT, and DET need to be calculated (see [Flow Chart 6.1: Product Decision Tree](#)).

Minimum Reserve

The Minimum Reserve for a group of policies is the maximum of up to three values as applicable:

$$\text{Minimum Reserve} = \text{Max}(\text{SR}+\text{DPA}, \text{DR}+\text{DPA}, \text{NPR}).$$

The excess of the Minimum Reserve over the NPR must be allocated to individual policies.

Net Premium Reserve (NPR)

Net premium reserves are a seriatim formulaic net premium calculation using fully prescribed assumptions with cash value floors similar to current CRVM with some differences. Non-ULSG, non-Term products retain current CRVM. Term has a CRVM structure with several differences. (See [Road Map Guide Assumptions NPR.](#)) The expense allowance is defined as \$2.50 per \$1,000 of insurance for the first policy year only. Prescribed lapse rates are introduced that are fixed and determined by product guarantees: the length of level periods and percent increase in the gross premium. Thus lapse rates are set at policy issue. There may be two “k-factors” (before and after the level period/shock year) to reflect an adjustment if beyond the level period the present value of valuation net premiums exceeds the present value of benefits by more than 35%. The adjustment utilizes the following relationship:

$$k^{LP} \cdot PV(AGP^{LP}) + k^{PS} \cdot PV(AGP^{PS}) = PV(Benefit) + EA$$

where *LP* denotes Level Period, *PS* Post Shock Period, *AGP* Adjusted Gross Premium, and *EA* Expense Allowance.

UL products have a CRVM structure with numerous differences. The expense allowance is defined the same as for Term - \$2.50 per \$1,000 of insurance for the first policy year only - and is amortized separately. Prescribed lapse formulas are introduced for ULSG with SG more than five years and vary according to policy values as of the valuation date as well as projected values. At each valuation date, an annual level gross premium (LGP) is determined to fund the longest secondary guarantee. LGP is a solve-for premium similar to the current CRVM GMP (guaranteed maturity premium); however, a GMP endows the policy while a LGP keeps the policy in force. ULSG may need to reflect different methods before/after the expiration of the SG period.

Stochastic Exclusion Ratio Test (SERT)

(See [Flow Chart 6.6: Stochastic Exclusion Ratio Test](#) and [Road Map Guide Assumptions SERT.](#)) SERT consists of calculating an adjusted deterministic reserve for 16 prescribed scenarios and calculating a ratio. The adjusted deterministic reserve (*DR'*) is the DR calculation with some differences, namely, assumptions with no margins. Contract types with significantly different risk profiles may not be grouped together (see DR). The numerator of the ratio is the maximum *DR'* over 15 nonbaseline scenarios less the *DR'* for the baseline scenario. The denominator is the present value of benefits for direct and assumed benefits for the baseline scenario from *DR'* (that is, all aspects of ceded reinsurance are excluded). The test passes if the ratio is less than 4.5%.

Deterministic Exclusion Test (DET)

(See [Flow Chart 6.7: Deterministic Exclusion Test](#) and [Road Map Guide Assumptions DET.](#)) DET consists of comparing the sum of the guaranteed gross premiums with the sum of the valuation net premiums for all future years on a group of policies where net premiums are determined using each policy's Net Premium Reserve method but with 0% lapse rates. No discounting is involved. For policies subject to shock lapses (e.g., Level Period Term) all future years are limited to the initial premium period (i.e., preshock years). It is on a direct or assumed basis.

Contract types with significantly different risk profiles may not be grouped together. For an individual policy the gross premium and net premium will not change over the lifetime of the contract. The test is performed on a group of policies, and a change in the mix of business may change the results of the test.

Deterministic Reserve (DR) and Stochastic Reserve (SR)

The SR and DR (and hence SERT) entail projecting cash flows including but not limited to future gross premiums and other applicable revenue, benefits, expenses excluding federal income taxes, net policy loan cash flows (if modeled), reinsurance cash flows (both discrete and aggregate reinsurance), net cash flows to/from the general account and separate account, revenue sharing, and future derivative liability program net cash flows. Projected cash flows reflect base policies, riders, supplemental benefits, nonguaranteed elements, policyholder behavior, company practices, and actions dynamically responsive to the scenarios as appropriate. The model should support negative assets or borrowing. Aggregate reinsurance must be allocated to the model segments.

SR and DR calculations are performed on cash flows from aggregation subgroups generated from cash flows modeled on Model Segments consistent with asset segmentation. SR and DR have a number of prescribed methodologies and prescribed conditions; that is, the company determines the method but must demonstrate that a prescribed condition is satisfied.

PBA introduces assets as part of the statutory reserve calculation for the first time. Projected asset cash flows affect portfolio earned rates. Dynamic liability assumptions often use a crediting rate strategy based on portfolio earned rates and lapse rates that are a function of credited rates. Aggregation introduces another complication in the interdependencies. VM-20 does not prescribe Model Segments and aggregation other than it should reflect company practice and asset segmentation policies. Multiple products within the asset segment could be assigned to different Model Segments and hence modeled independently and then aggregated, or they could be assigned to the same Model Segment and modeled together.

If two products, for example, Term and UL without SG, are included in the same model segment, then each product affects projected earned rates. Hence the liability cash flows of one product will affect the other product through the interdependence of the assets and the timing of cash flows and offsetting of positive and negative cash flows. In this case aggregated results within the Model Segment are not the sum of the individual products. For example, the positive/negative cash flows on a standalone versus aggregated basis result in different reinvestment or disinvestment decisions resulting in different emerging earned rates. This would produce credited rates, dynamic lapses, and liability cash flows different than originally calculated by the liability models.

Modeling asset-liability interdependence is challenging. Considerations should be given to model simplifications, run times, granularity, accuracy, and interdependencies between assets and liabilities.

SR and DR have a chicken and egg problem. The Starting Assets, SR, and DR are interdependent since there is a prescribed condition that for all model segments combined the Starting Assets must be within a 2% collar of the final aggregated modeled reserves. However, the SR and DR each depend on the Starting Assets. Since the minimum reserve for a model segment is the maximum of the SR+DPA, DR + DPA, and NPR (as applicable) the SR can affect the DR and vice versa. The condition applies across all model segments combined so one segment can affect another. If the collar is not satisfied, either the model can be rerun after adjusting the starting assets (i.e., iterate until the condition is met), or the company shall provide documentation that provides reasonable assurance that the aggregate modeled reserve is not materially understated. (See [Flow Chart 6.10: Starting Asset Constraint](#).)

Other prescribed methodologies include asset defaults and spreads and mortality as described in the [Assumption Section](#). The model calculations must support the granularity and structure of the assumptions, which also include blending and grading over projection years. Gross spreads on new public noncallable bonds assets purchased are determined by a prescribed methodology. Other purchased assets do not have prescribed spreads but are to be consistent with public noncallable bonds. In addition the reinvestment strategy is subject to a minimum floor condition: the strategy must not produce a lower minimum reserve than would result using an alternative investment strategy consisting of a blend of "A2/A" and "Aa2/AA" public noncallable corporate bonds. Equity investment assets are mapped to proxy funds. The Interest Maintenance Reserve is on a pretax basis.

Deterministic Reserve (DR)

The DR is a gross premium reserve calculation defined as the present value of future benefits and expenses less the present value of future premiums and other revenue items using the path of net asset earned rates as the source of the discount rate. The DR includes only liability cash flows and does not include asset cash flows. Assets are reflected via the discount rates, which are the path of net asset earned rates as the source of the discount rate.

Stochastic Reserve (SR)

The SR is the CTE70 of Scenario Reserve over a set of stochastic scenarios. The Scenario Reserve is a greatest present value of accumulated deficiency calculation (GPVAD). The GPVAD is the largest discounted value of the negative of the asset values at the valuation date and each projection year-end discounted to the valuation date using the path of the beginning of year 1 Treasury rates subgroups summed across the aggregation; that is, discount each of the negative accumulated deficiencies as of each year-end, sum across the aggregation subgroups, and set the Scenario Reserve equal to the largest value.

Model Capabilities and Interdependent Considerations

VM-20 does not require anything beyond being able to calculate reported reserves (i.e., Stage 1 Acquisition). Many companies will require more. Some companies will want to be able to project reserves for business planning, pricing, or risk management purposes. Projections may require deterministic on deterministic or stochastic on stochastic capabilities. Some companies will want to be able to explain results. This may require additional calculations. Accuracy of

output to support business planning will likely be more demanding in a financial statement setting than in cash flow testing. VM-20 states, “A company may use simplifications, approximations and modeling efficiency techniques to calculate the net premium reserve, the deterministic reserve and/or the stochastic reserve.” Considerations and trade-offs regarding model simplifications, run times, granularity, accuracy, and interdependencies between assets and liabilities must be balanced.

Models need to be built during implementation and operated and maintained post-implementation. Models can have hundreds of model parameter settings to describe complex products and their premiums and benefits, assets and market values, assumptions such as timing of cash flows, and company and policyholder optionality. Models and model systems will not support everything.

Models will be subject to governance policies. Models need to be changed and the hundreds of settings controlled. Models need to be validated. Models need to produce output whether in raw, intermediate, or final form. Model output can facilitate validation.

Models will be used to perform the calculations for multiple realizations. Models need to select and/or use the right inputs such as assumptions, margins, model parameters, and methods corresponding to reported values, the required quantification of margins, and sensitivities. Models will need to be able to support required demonstrations such as the Stochastic Exclusion Demonstration Test and prescribed reinvestment strategy conditions and that any simplifications, approximations, and modeling efficiency techniques are acceptable. Models need to support analysis and explanations. The model system, number of policies, and model choices will affect run time. Model systems need supporting technology and may involve distributive processing.

Model System

There are a number of considerations in choosing a model system. Remaining on the current model system can be viewed as a default choice. Some companies may reevaluate their current system. If so, a cost-benefit evaluation can be utilized to choose the right system aligned with company strategy and needs. Model benefits include the quality and degree to which the model supports business and reporting requirements. To the extent models are utilized in making strategic and tactical decisions in managing growth, earnings, and risks, the benefits of having the right model and the costs of not having the right model can be significant.

One cost consideration is license fees. Another sometimes larger cost consideration is the amount of resources including staff size and time required to use the systems: to convert, implement, operate, and maintain the models on the system. A model system conversion is a huge undertaking, and conversion projects are often measured in years not months. Required resources are related to processes supporting the models through the building, validating, operating, and maintaining stages. Processes are related to what the system can do or cannot do and how the system does it. All-in costs consist of changes required of the current system or to convert to new systems, initial and ongoing outlays or license fees, implementation

manpower (internal or external), consulting, training, business continuity, and supporting technologies.

The Financial Managers Society published the 2013 paper [*Choosing the Right Asset/Liability Management Model Solution and Keeping It Accurate!*](#), an objective guide for institutions in choosing the right vendor A/L model. Although it is for banks ALM models, the issues, considerations and guidance are relevant and adaptable to modeling systems for life insurance companies. The paper is highly recommended to any company considering the purchase of a new system. Sections include the following:

- *A Framework for Choosing the Right Level of an ALM Model* (i.e., how powerful it is) including a comparison of benefits and costs of ALM models
- *Review Elements for Choosing the Right In-house ALM Model* including ALM model selection criteria and requirements such as ease of use, fundamental ALM model capabilities, data extract, download and input data capabilities, equity-at-risk analyses, stochastic modeling (Monte Carlo) capabilities and budgeting, profitability, and funds transfer pricing
- *Periodic In-House Model Risk Assessment* covering the ALM model itself as a risk source, ALM model components as risk sources and model control environment
- *Evaluating ALM Model Risk Assessment Providers*
- *Choosing and Outsourcing Solution and Keeping It Accurate*
- *Sample Request for Proposals*

The right PBA model system could be an open architecture facilitating company-specific code to develop differentiated products and develop innovative management methodologies utilizing company and staff competencies. The right model system could be a fully robust model supporting complex and sophisticated liabilities and assets requiring substantial resources to operate. The right model system could be a low-cost system that is easy to operate with limited staff. The right system could be an in-house system that effectively and efficiently supports the company's needs that is already fully integrated into business planning, product development, and risk management without the overhead of supporting every company's needs.

8.4 Outputs

PBA outputs are extensive, perhaps overwhelming. There will be vast volumes of model output associated with the exclusion tests, stochastic reserves, deterministic reserves, and net premium reserves in the financial statements, the associated quantification of margins, and assumption sensitivities. There will be vast volumes of analytical output to validate, analyze, attribute, and explain results. The VM has substantial documentation and disclosure requirements.

Experience Data

VM-50 and VM-51 prescribe highly detailed experience reporting requirements and formats. The transition period does not apply so VM-50 and 51 are effective immediately upon VM

adoption. Companies with direct individual life insurance premium below a threshold are exempt.

Principle-Based Reserve (PBR) Actuarial Report

VM-31 requires that each year a company shall prepare a PBR Actuarial Report, a confidential document, provided to the regulator on request. The Report has substantial documentation and disclosure requirements prescribed in great detail including descriptions of the assumptions, margins, and methods to develop them and at least every three years an actual to expected analysis. VM-31 requires quantification of the impact of individual margins on the deterministic reserve for each risk factor(s) that has a material impact and the aggregate impact of all margins and an explanation of impact of sensitivity tests in developing assumptions.

VM-31 prescribes the information to be included in the Report to describe the assumptions. For example, the mortality assumption should provide a description of each mortality segment, results of applying credibility criteria, results of applying the underwriting scoring procedure, summary of experience for each mortality segment, rationale for any adjustments to experience, description of credibility procedures, summary of credibility adjusted mortality, impact of any changes in the mortality credibility procedure, impact of adjustments for impaired lives or policyholder behavior, actual margins used, and the results of an actual to expected analysis.

The Report shall include tables of all products in force showing current year premium, face amount in force, and reserves listing PBR and non-PBR valued products separately. For each major product line a set of tables on a net of reinsurance basis, on a gross basis with direct and assumed separated, summaries for groups of policies that failed SET showing NPR, DR, CTE 70, Additional reserves, SR, and the Reported reserves; summaries for groups of policies that passed SET but failed DET showing NPR, DR, and Reported reserves; and a summary for policies that NPR was not calculated. See Table 8.4.1.

**Table 8.4.1
Passed SET, Failed DET**

Product	NPR	DR	DPA	Reported Reserve
Term				
Non-Par Whole Life				
UL w/o SG				
...				

Failed SET

Product	NPR	DR	CTE 70	Additional Reserve	SR	DPA	Reported Reserve
Term							
VUL							
ULSG							

...							
Total							
					General Account		
					Separate Account		

Cash flow model disclosures are numerous, for example, the rationale for model segments, the approach to group policies and assets for deterministic and stochastic calculations, the approach used to validate model calculations within each model segment, how the model results compare with actual historical experience, a description of how policy loans are modeled, a description of how reinsurance cash flows are modeled, and a description of the asset investment strategy.

Other requirements include the results of the exclusion test ratios and the 16 scenarios, the impact of individual margins and margins in aggregate on deterministic reserve, an explanation of impact of sensitivity tests in developing assumptions, the impact of aggregation on the stochastic reserve and descriptions, and demonstrations of any approximations and simplifications used in reserve calculations.

Business Requirements

What output and reports will be needed to support management, internal, and external audit and other company functions? The stochastic and deterministic reserves will be more volatile than current statutory reserves. Therefore statutory earnings will be more volatile. The breadth and depth of output to support analysis to validate, interpret, explain, and evaluate will depend on business requirements and business strategy. Depending on the desired capabilities in the [five stages](#), output and analytics may be needed to support business planning, product development, and risk management. Analyzing and getting comfortable with results is different in a cash flow testing pass/fail setting versus an earnings and attribution analysis setting.

Considerations

While nearly all the participants interviewed for the Guide have fully automated and controlled processes to produce financial statement entries the majority use a collection of Excel spreadsheets to analyze, interpret, and explain the financial entries. Often the calculation programs or formulas were not subject to change controls or access controls. For cash flow testing, in addition to analytics, Excel spreadsheets are also used to capture and stage the results producing the reports in the actuarial memorandums. There is some degree of automation, but the process to produce analytics in both financial reporting and cash flow testing is resource and time intensive, and the control environment is less stringent to nonexistent.

A heavily manual process to assemble PBA reports or analytics is likely to cost more than companies anticipate: cost to maintain, cost in resources and calendar time, and cost in analyses not performed. Reports and analytics include regulatory reports, audit reports, management reports, reconciliations of inputs and outputs, analytics probing the relationships between outputs across scenarios, sensitivities with and without margins, net and gross of

reinsurance, prior reporting periods, and projected/expected values. Automation in the production of reports, analytics, and comparisons will be critical to provide the necessary time to review results, to explore relationships, and to understand drivers. An alternative to consider is reporting on a one-quarter lag basis.

Companies certain of passing the exclusion tests may have more modest needs and avoid the volume and time pressures during a financial close associated with deterministic and stochastic reserves.

A solution to managing output and producing reports within a secure controlled production environment is a centralized database with reporting tools. Available databases and tools run the spectrum from light to deluxe versions—from viable open source databases with prebuilt reporting tools to million dollar databases and highly sophisticated analytical engines, data cubes, and reporting tools. There is a wide range of prebuilt and/or developmental capabilities and a wide range of resources required to build, operate, and maintain databases and tools.

Capabilities to consider include the following:

- Production reports and analytics including financial and PBR Actuarial Report entries can be automated
- Reporting tools enabling drilling down into details
- Desired governance and controls can be implemented regarding access, extraction process (validation statistics), the calculation programs, and business rules underlying the production reports and queries
- Automated checks can be built comparing input and output control validation metrics (count, in force amounts, account values, cash values, sessions, book values, etc.)
- Flexibility to create new analytics, to evaluate data, and to explore relationships differently as needs arise
- Structured templates for analysis appropriate to each model segment that aids in variance analysis, including identifying sources of recurring and nonrecurring earnings
- Automated “flagging” based on variance thresholds and predictive triggers to focus analysis efforts
- Automation supports version control and increases time for analysis
- Facilitate measuring the impact of emerging experience and variances versus assumptions on results and forecasts
- A knowledge management system to create and transfer knowledge related to hows and whys learned during off-close and financial close cycles

The benefits of automated reports, analytics, and drill-down capabilities are only as good as the populated content and the choice of analytics. Model output is an intermediate step in producing output. A consideration is the manipulation and adjustments to model output, items calculated outside the primary model or systems, and adjustments for nonmodeled items. For business planning, there is often considerable assembling of intermediate outputs followed by intervention and adjustments to fine-tune the plan. A consideration is being able to keep the

modeled values, nonmodeled values, and adjustments distinct. This would be analogous in the accounting world to keeping manual journal vouchers distinct in a ledger system. There is also a need to balance the quantity of reports and analytics versus what is truly necessary or insightful. More is not necessarily better.

The rigor and control around the standard set of reports used for analysis, and what analytical relationships are measured will be continuously evolving. A consideration is starting out with rudimentary capabilities followed by incremental progress in the reports produced and reporting capabilities. For example, develop something basic with placeholders to get to a test run capability stage. Then during the test runs evaluate processes and pain points, controls, reports, and analytics and their usefulness and then target incremental improvements. During the test run stage and initially after implementation, since there is just one year of issues, demands such as run time, material impacts, and financials will be mitigated, allowing one to learn how to improve the processes and better analyze results.

Output Management

- Centralized database
- Data repository and interfaces

Output Process and Analytical Engines

- Process to capture, manage, stage, and control output data
- Adjustments to data
- Process to validate output and input
- Process to create reports, analytics, and management information
- Reporting tools
- Automation

Output Governance and Documentation

- Centralization
- Steward
- Policies
- Formalize procedures
- Access

Analysis and Explanations

- Choice of reports and analytics
- Knowledge management system

Supports Business and Reporting Requirements

- Content, quality, and granularity
- Management reports

[Five Stages](#)

8.5 Technology and Systems

Meeting PBA requirements will push system and technology demands in hardware, software, applications, and governance in many areas including computing capacity, processing speed, memory, storage, and capabilities. Technology is a critical component in improving processes to be more efficient and effective. Technology supports automation, centralization, model run times, managing, and analyzing inputs and outputs and governance issues such as version control, change control, documentation, and security.

Hardware/Computing Capacity, Storage, Database, Reporting Tools

A key PBA consideration is what, when, and how much technology will be needed. In regard to hardware and computing capacity, alternatives include mainframes, desktops, servers, grids, clouds, and farms. Considerations in evaluating these alternatives include computing power, scalability, ease of use, time to implement, risk, reliability, and implementation and operational costs.

Some companies will have existing distributive computing capabilities to support variable annuities, VACRVM, C3 Phase II, hedging, asset liability management, or other business needs. Existing capabilities can be leveraged to extend to PBA needs. Companies that do not have distributive capabilities will explore available choices.

Companies needing to calculate SR and DR reserves will have to run models many times, far beyond current needs for pricing, reporting, and cash flow testing. Companies passing both exclusion tests for all their products will have needs similar to cash flow testing. The stochastic exclusion ratio test will likely be run off cycle, not during quarter-end, and has 16 scenarios, about double the New York 7.

Consideration should be given to how many runs and re-runs will be needed, how long runs take, and the financial close schedule. A run could mean each scenario, each sensitivity run, each run with/without a margin, each iteration to reflect asset and liability dependencies, each iteration to solve for starting assets, each run to quantify an assumption change, or other attribution analysis. The amount of storage needed will depend not only on how many runs but also on the breadth and granularity of the output and data retention policies.

There are numerous alternatives to store and manage input and/or output data including Excel, Access, SQL (SQL Server, MySQL, Post-GreSQL), Oracle, Terradata, DB2, and Sybase. There are numerous reporting tools as well. Considerations include memory, space, processing speed, scalability, ease of use, time to implement, risk, reliability, and implementation and operational costs. There are many applications that can facilitate governance including controls, security, access, and segregation of duties, documentation, and a host of other work-related issues.

Initial financial close needs will be mitigated due to PBA applying only to new issues. The PBA block will not be as material in respect to financial statements and to run times. However, during implementation time and space will be needed to evaluate model choices such as assumptions, margins, assumption granularity, model cell granularity and compression,

scenario compression, model segments, mortality segments, and methods and to gain insights into how PBA will impact reported results and business plans. Some companies will redesign products, reevaluate reinsurance, and other risk management measures and revisit accounting-based decisions. Simply put, many PBA implementation activities cannot occur without the supporting technology.

Needless to say, IT collaboration will be essential in planning, evaluating, and making PBA an operational success. An honest assessment of the work, computing power, and data requirements prior to implementation will help your company make the right choices. Where are the weakest/slowest links: premodel processing, model run time, and postmodel processing? At least one thing is near certain. In the upcoming years as companies go from planning to implementing to operating PBA choices, speed, storage capacity, and cost will become only faster, bigger, stronger, and more affordable.

8.6 Actuarial Organization

It may seem that the Guide has been about things and processes. PBA will have a substantive impact on models, databases, outputs, grids, clouds, assumptions, policies, and how tasks get done. However, the most significant impact is likely to be on people. And the biggest differentiator in a PBA world will be people, not models or grids or policies.

PBA implementation is a people project. Large changes in an organization often incur responses ranging from excitement to active or passive resistance based on tolerance for change. PBA is a large change and will cause displacement, provide opportunities, change roles, and alter career paths. There will be a shift in attributes, skill sets, activities, and responsibilities that are or are perceived to produce value.

Talent management will be paramount during PBA implementation. First is getting the right people into the right roles who will choose to do the right things, select the right platforms, apply the right resources, and execute the implementation successfully. There will be a need for designers, architects, builders, and mechanics as seen by the following series of questions. What and how will PBA activities and processes align with strategy and requirements? How will the requirements be translated into model, database, reporting tool, and governance architecture? How will the initiatives be planned and executed? What and how will validations, model, assumption-setting and analytical methods, and processes be built and operated? How will models and reporting tools be run, re-run, enhanced, and fine-tuned as implementation progresses from can perform a calculation or task to understanding the relationships in product features, assumptions, reserves, and earning drivers? Second is managing and retaining talent. There is likely to be competition in procuring talent. Performers will be pursued. Performers who are not rewarded or provided growth/career path opportunities will explore options.

PBA implementation will require sufficient human resources and competencies. PBA resourcing can range from additional work on top of current workloads to fully dedicated teams. Much will depend on the speed and intensity in implementing and ramping up capabilities. Work can be

steady over several years or occur in bursts. Team availability especially key resources, continuity (turnover), ability to complete tasks, and bench strength and depth all affect project progress. Many companies will engage consultants to provide thought leadership or provide targeted expertise, support, and review or provide substantive work efforts to convert systems.

Considerations

Organization Chart/Structure, Culture

A consideration will be actuarial organization and functional responsibilities. Will the organizational chart/structure remain the same in a PBA world? To what extent are departments functional silos versus cross-functional: currently, during implementation, and post-implementation? Which departments will be responsible for which parts of the implementation? Implementing PBA will require collaboration and more collaboration.

Organizations may encounter resistance to changes due to a lack of understanding, different assessments, self-interest, or low tolerances for change. The biggest challenge is changing people's behavior. The tone and the importance placed on PBA from the top and support systems, including information systems, communication, training, and skill development technology, will all be important factors.

Staff size, or the need to add staff, will be a primary budget consideration especially in regard to future operational costs. Will other implementation activities decrease or increase staffing needs post-implementation? Staff needs depend on other choices such as automating processes, the robustness and/or flexibility of systems and platforms, and the business demands. Some systems are more or less resource intensive to implement and operate than others.

Competencies, Skill Sets, and Knowledge

Requirements and considerations such as skill sets will be different for implementation versus operations. It will be important for companies to identify attributes, skills, and knowledge desired in a PBA world, develop current staff, and select those competencies in future hires from entry to senior levels.

What, when, and how will training be provided to current staff? How many staff will become the subject matter experts on all or designated parts of VM-20? Ideally at least one person should be designated to develop familiarity with VM-20 and industry practice. Training cannot happen all at once, nor should a long period elapse between training and utilization. The necessary knowledge expertise is part valuation and part modeling. Training resources include literature, webinars, seminars, conferences, and consultants. Expertise takes time to develop. Even with expertise expect difficulties during implementation.

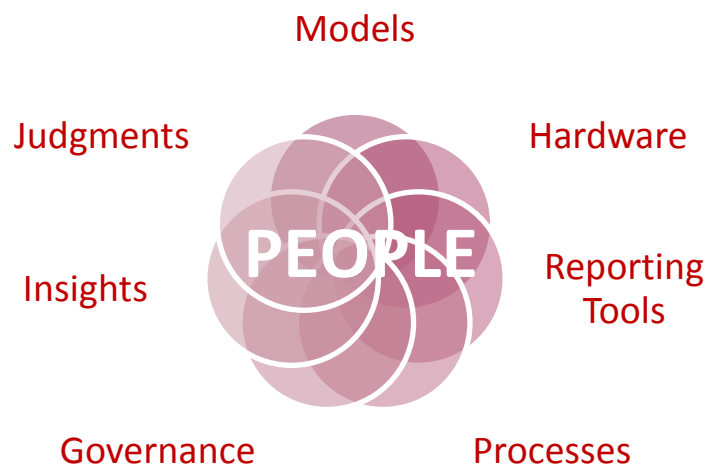
Collectively, staff will need a rich set of competencies such as valuation knowledge, liability, asset and investment knowledge (including derivatives and hedging if applicable), designing and building skills in models, databases, reporting tools, controls and automation, model operation, model validation, ability to evaluate results, broad business understanding, soft skills,

documentation, inductive reasoning, critical thinking skills, ability to discover and understand relationships, ability to figure things out in ambiguous settings, ability to link intelligence, decisions, actions, and results, and the ability to interpret communicate, explain, and persuade others such as management, board, auditors, regulators, and rating agencies to accept and/or to act on results—in short, all the competencies that make actuaries valuable.

Imagine football rules had not permitted passing and then the rules changed allowing passing. New and different skills would be valuable—passing, pass rushers/blockers, receivers, and corners. Which skills might be valuable in a PBA world? Consider two examples. The first example is validating and getting comfortable with the calculated reserves. With formulaic reserves deductive reasoning is valuable. Given a set of inputs one deductively calculates a set of outputs that should follow established patterns. With PBA SR reserves, inductive reasoning is valuable. An analogy is, suppose one is given a set of outputs from a mixing blender. Are the results reasonable given what the ingredients or inputs are supposed to be? Was there too little/too much of the ingredients or a missing or extra ingredient?

The second example is providing earnings explanations due to changes in reserves. An analogy is traveling in a car or a helicopter from point A (one period) to point B (the next period). For formulaic reserves a car, given the street addresses, travels from A to B. The actuary looks out the window and records the route taken by using reserve roll forward to perform attribution analysis and attribute earnings impacts. For stochastic reserves the actuary is shown the surroundings at point A and then flown to point B and shown the new surroundings. Is B the right place or should it have been C? Parts of the trip were visible, but some were not. Can you discover and explain how you got to B?

All the infrastructure, models, tools, automation, and governance policies facilitate and enable people. The challenges in a PBA world will be solved through collaboration and people exercising wisdom and judgment to make actuarial and business decisions in the face of ambiguity.



8.7 Potential Road Map Initiatives

This section provides potential initiatives a company might undertake during implementation.

1.0 Assumption Setting

Experience Studies

- 1.01 Evaluate platform(s); convert or enhance platform
- 1.02 Centralize data storage and experience studies
- 1.03 Establish a schedule to produce studies

Information and Sources

- 1.04 Expand data capture to increase granularity and content (policyholder behavior such as premium patterns, policy loan activity, conversion election rates, and postconversion mortality)
- 1.05 Explore and secure supplemental data sources (for mortality, lapses, etc.)
- 1.06 Accelerate the delivery of assumption inputs obtained on/after the last day of the close
- 1.07 Cleanse data. Reconcile with audited financial information (e.g., claims, premiums, surrenders): Experience Study data + Adjustments = Financials

Processes and Analytical Engines

- 1.08 Rationalize or remediate manual and intervention processes
- 1.09 Establish procedures to input assumptions into the models and validate it was done correctly
- 1.10 Explore alternative methods and granularity; refine analytical level of details
- 1.11 Explore predictive modeling methods
- 1.12 Develop blending, grading, and credibility-weighted methods
- 1.13 Develop actual versus expected analytical tools
- 1.14 Develop production and ad hoc report capabilities
- 1.15 Evaluate a centralized location for assumption storage (current and historical) versus centralized database

Setting Assumptions and Margins

- 1.16 Develop and formalize philosophy for setting assumptions and margins
- 1.17 Develop assumption review schedule/calendar for key assumptions
- 1.18 Implement a formal sign-off process for the setting of model assumptions
- 1.19 Develop centralized development, setting, and approval of neutral view
- 1.20 Develop process to set SR/DR mortality assumption
- 1.21 Develop process to set asset default charges
- 1.22 Define margin explicitly
- 1.23 Review CFT assumptions for (over-) conservatism
- 1.24 Analyze and document key assumption sensitivity including dynamic formulas (interdependent with Model)

- 1.25 Analyze and document the impact of each significant assumption change (interdependent with Model)
- 1.26 Evaluate variables to stochastically model besides interest rates and equity returns
- 1.27 Evaluate correlations

Assumption Governance and Documentation

- 1.28 Evaluate and develop assumption governance structure within PBA reporting and/or integrated with other actuarial functions
- 1.29 Formalize existing activities
- 1.30 Establish assumption-setting policy: update/review timing and frequency, storage, location, access, communication
- 1.31 Establish policies and procedures pertaining to consistent application of neutral view and methods across models, blocks of business, and reporting bases as appropriate
- 1.32 Implement a formal sign-off process for the setting of model assumptions
- 1.33 Classify assumptions according to materiality
- 1.34 Develop controls for experience study data, calculations, outputs, interfaces, policy reviews
- 1.35 Develop an assumption dashboard including tracking last update and last review
- 1.36 Document methods to determine experience assumptions and margins
- 1.37 Review disclosure requirements: VM-31, VM-50, and VM-51 (see 4.10)
- 1.38 Develop a feedback/monitoring mechanism

2.0 Inputs

Input Management

- 2.01 Evaluate a centralized location for input storage versus centralized database

Input Process

- 2.02 Automate model input data interfaces where feasible
- 2.03 Explore and analyze alternatives regarding inventory compression and/or scenario reduction
- 2.04 Involve IT to improve automation and controls
- 2.05 Automate data validation for inventory statistics such as count, in force amounts, account/cash/market values
- 2.06 Develop and automate validation for other inputs
- 2.07 Streamline input interfaces

Input Governance and Documentation

- 2.08 Evaluate and develop input governance structure within PBA reporting and/or integrated with other actuarial functions
- 2.09 Formalize existing activities
- 2.10 Document and comply with standards regarding reliance

- 2.11 Standardize a set of inputs to test changes
- 2.12 Standardize a set of test analytics performed to test model input

Supports Business and Reporting Requirements

- 2.13 Expand input content to support Model and Output
- 2.14 Reduce intervention points in capturing, processing, and staging inputs
- 2.15 Evaluate granularity of inputs

3.0 Model

Model System

- 3.01 Evaluate current system
- 3.02 Enhance and expand current model system
- 3.03 Develop requirements—what, can, how, cost—for new systems
- 3.04 Solicit and evaluate Requests for Proposals (RFPs) and select new systems
- 3.05 Convert systems

Reserve and Other Calculations

- 3.06 Build models for NPR, SET, DET, SR, DR, demonstrations, sensitivities, and other requirements as applicable
- 3.07 Validate models
- 3.08 Experiment with models to develop assumptions, margins, analytics, etc., to evaluate impacts of different methods, granularities, aggregations, and VM-20 interpretation, to gain insights into PBA drivers, and to evaluate current products
- 3.09 Implement projection and/or business planning models and processes
- 3.10 Implement product development models and processes
- 3.11 Implement risk management models and processes

Model Governance and Documentation

- 3.12 Evaluate and develop model governance structure within PBA reporting and/or integrated with other actuarial functions
- 3.13 Formalize existing activities
- 3.14 Document and comply with standards

4.0 Outputs

Output Management

- 4.01 Evaluate a centralized database versus other repositories and interfaces
- 4.02 Automate and standardize model output used for reporting and analysis
- 4.03 Implement a database to facilitate reporting and analysis

Output Process and Analytic Engines

- 4.04 Automate and/or streamline output data interfaces where feasible

- 4.05 Evaluate reporting tools; implement reporting tools
- 4.06 Involve IT to improve automation and controls
- 4.07 Automate data validation

Output Governance and Documentation

- 4.08 Evaluate and develop output governance structure within PBA reporting and/or integrated with other actuarial functions
- 4.09 Formalize existing activities
- 4.10 Document and comply with standards (VM-31, VM-50, and VM-51; see 1.37)
- 4.11 Standardize a set of test analytics performed to test model Output

Supports Business and Reporting Requirements

- 4.12 Expand output content to support management reports and analytics
- 4.13 Reduce intervention points in capturing, processing and staging outputs
- 4.14 Evaluate granularity of outputs

5.0 Technology and Systems

- 5.01 Enhance and expand current computing power technologies
- 5.02 Evaluate and implement computing power technologies
- 5.03 Enhance and expand current database technologies and reporting tools
- 5.04 Evaluate and implement database technologies and reporting tools
- 5.05 Evaluate and implement technology to automate processes and/or centralize data and controls

6.0 Actuarial Organization

- 6.01 Identify, develop, and acquire required competencies, skill sets, and knowledge
- 6.02 Train staff
- 6.03 Implement support systems
- 6.04 Identify potential owners and select who should be asked to champion each issue
- 6.05 Identify potential significant partners (other departments) whose support will be needed
- 6.06 Assess resource skill and availability gaps in amounts and durations to support existing initiatives and workloads *and* support PBA implementation
- 6.07 Evaluate if resource needs are temporary during stages of the project or temporary

9 Participant Comments and Author's Observations

The majority of comments and feedback from participants have been incorporated throughout the Guide. Two common questions have been “How might PBA implementations vary by company size or other factors?” and “What are others doing?” These and few other areas of discussion warrant additional coverage.

We asked, “What do you want from the Guide?”

“A skeleton to help provide steps and dependencies to get to the end.”

“What are key decisions; time and effort estimates.”

“A basic primer in PBR. How will it affect straightforward products?”

“A document to take to management and tell them what you need to complete job (for budget review and management approval).”

“What are others doing and am I out of step with that.”

“I need to sell my boss that I need a bunch of resources.”

“Are we doing too much or too little? Good enough or more than necessary?”

“How it affects certain companies or not? Have to do something or not?”

“Direction of where to start.”

“Summarize process—pay attention to these things and ignore these things because they don't apply to your company.”

“Input on what others are thinking.”

“Ask questions to make us think of things earlier rather than later.”

“Help sell this to management—any information to provide to management—manpower, time, data requirements. The scope is really this big.”

“Know/learn our weaknesses: data gathering ... staffing (need more actuaries?) ... “

“Figuring it out.”

“We want to make sure there is enough lead time (for example if we need three years).”

We asked, “Where are you in preparing for PBA?”

Some participants had formed teams; all were early in the process. Nearly all felt that they had done less than other companies. Many participated in the Impact Study, but most calculations were done in ad hoc fashion in Excel outside their models. A few comments follow:

“Outside of this (Impact Study) we have done nothing.”

“We as a company lack a sense of urgency. We (actuarial) are looking at modeling, hardware, assumptions, data storage, and the ability to analyze.”

“We are improving data and experience studies.”

VM-20 Impact Study

Many participants also participated in the NAIC VM-20 Impact Study authored by Towers Watson. Our Guide participants did not feel that participation in the Impact Study meant they were further along in PBA implementation than nonparticipants. However, participation helped them appreciate the issues and challenges implementing VM-20 would present. Common denominators were that participants were challenged by the Impact Study and calculating reserves was time consuming. Prescribed assumptions such as mortality and defaults took considerable effort. Participants took shortcuts to approximate the default methodology. The iterative process to meet the starting asset constraint was run-time intensive. They made numerous interpretation mistakes. Compiling results took time, and understanding results was difficult. Finally, it was apparent there would be large amounts of documentation.

Audit and Regulatory Demands

Audit and regulatory demands and resource implications were correlated by asset/staff size. The schedule during the year and the activities were similar across the companies. However, audit and regulatory activities consume a large percentage of available staff time for small companies, making it difficult to simultaneously carry out other activities. Large companies did not feel audit or regulatory demands were onerous but could not answer how much time it took their staff, that is, man-days. They did know when periods of peak requirements occurred. Small companies were acutely cognizant of audit and regulatory demands because there were periods that required the focus of most or the entire staff. Smaller companies also struggled to obtain information requested by audit, and the associated processes were time consuming. Activities such as Sarbanes-Oxley, Model Audit Rule, and the Actuarial Opinion Memorandum represented significant resource consumption.

Small companies view certain VM requirements regarding data, assumption-setting methods, and especially documentation to be overwhelming, whereas large companies view these requirements at worst as challenging.

Documentation and Knowledge Management

In general, there was a lack of active knowledge management systems. For example, assumption documentation (non-cross-functional) tends to reside within each function, and there was little documentation for cross-functional teams. A few of the large companies had single locations of documentation for each function. The mid-/small companies ranged from documentation or knowledge in many locations (files in many directories belonging to individuals on desktops/servers, emails) to a few locations. Although the current Actuarial Opinion Memorandum summarizes most of the *what's*, the majority of companies did not have documentation on *why*, that is, the justifications of methods/assumptions.

Use of Statutory Reporting Only

Informally, there was a correlation between small asset size and reporting only on a statutory basis, that is, no GAAP reporting or Economic Capital calculations.

Actuarial System Conversions

Strong opinions were expressed regarding Case Study 4, which entailed a model system conversion. Several of the participants had purchased new actuarial software systems three to five years ago. The general experience was that without using external consultants it took two to four years to begin using the system (partially either by product line and/or by actuarial functions), and each of these companies was still in the process of converting.

A key factor in being able to manage the speed and pacing of their conversions was the ability or inability to form a team of several staff members dedicated to the conversion efforts that would not be interrupted by ongoing responsibilities, specifically quarter-end financial reporting and business planning activities. Annual cash-flow-testing responsibilities did not significantly impede conversions, and cash-flow-testing capabilities were typically conversion milestones. Companies in which conversion team members retained reporting duties found conversion progress to be intermittent and to span a year or more per product line.

Participants felt that if Case Study Company 4 did not have staff availability to dedicate to the conversion, then it would need to use external resources or face a high probability of PBA implementation failure. If the conversion were the number one priority of two or three staff, then the timeline in Road Map 4 seemed reasonable (such as nine months per product line).

VACRVM

Companies that implemented VACRVM and Actuarial Guideline 43 had relevant experiences. Companies with rich and complex product guarantees had numerous implementation challenges related to interpreting requirements, setting assumptions, modeling, establishing governance and controls, documenting, and working through issues with auditors. Some companies found that their interpretation or intended calculations were not supported by the software system and had to work through those issues. Common denominators were that it took time to figure things out (more than first planned) such as understanding results and implications of interpretations, assumptions, and other inputs.

Companies with greater requirement demands (e.g., run times) have already invested in computing solutions (e.g., grids). Companies with benign VA features or with no VAs do not currently use grids. PBA demands thus range from incremental (adding processors to the current solution) to selecting and installing a computing solution.

Model Compression

Participants were split into two camps. One camp will eschew and the other camp will embrace model compression and other modeling efficiency techniques. The former either desire greater accuracy or do not feel compression works because they need or can manage the run times. The latter see compression as enabling more runs in less time. Thus compression facilitates more sensitivities and analyses which are critical to VM-20, risk management and economic capital activities. The latter are building considerable time in the Road Map to ensure compression produces the quality of results they need.

Potpourri

[Deterministic and/or stochastic] “Reserves do not always change like you think with changes in assumptions.”

“Our philosophy on assumptions and margins will evolve; we will not produce original ideas. Our analytics will also evolve. In a PBA world we need to learn to drive, and there will be a considerable learning curve.”

“Resources—it is not clear how resources will be made available. That is, resources will not be there to stay in front of the game. Hopefully much can be done by transitioning [over time].”

“Those most concerned with PBA are not the decision makers. Management will wait until the last moment.”

“Required skill sets [for PBA] will grow organically by being exposed to the environment and work demands.”

“Project Management and interaction with IT will be a big thing.”

10 Literature Resources

A proliferation of publications has taken place on issues relevant to a PBA paradigm, including Research Reports commissioned by the Society of Actuaries, Practice Notes, Actuarial Standards/Exposure Drafts, and Surveys. Topics range from models and governance to assumptions, margins, professional guidance, and more. Insights can also be learned from international practices that consider many related issues, although differences in regulations and standards can be significant. For example, the United Kingdom's technical actuarial standard M discusses the concept of model parsimony.

Literature resources are provided and split into primary and secondary resources. Collectively they provide additional considerations, perspectives, and details. In addition other publications such as *The Actuary* and the SOA Section newsletters contain many relevant articles. The authors do not carte blanche recommend adoption of any specific practice or conclusion contained in these resources. As with all the considerations contained in this Guide some will align and fit with your business strategy and requirements and some will not. We feel that exposure to a diversity of viewpoints that agree as well as disagree is a necessary ingredient in implementing a PBA framework. The resources collectively represent current thought leadership by our industry and the actuarial profession.

The [Blue](#) hyperlinks in this chapter are all external links: URLs to websites and files.

Primary Resources

National Association of Insurance Commissioners, [Valuation Manual, as adopted in December 2012](#).

Practice Notes

Practice Note on Life Principle-Based Reserves under VM-20 (to be published by the [American Academy of Actuaries](#)).

This practice note will be essential in interpreting VM-20 requirements.

There are several other pertinent Practice Notes by the [American Academy of Actuaries](#). Many VA issues and C3 Phase III considerations have much in common with the VM-20 issues actuaries will confront.

[Practice Note on Asset Adequacy Analysis](#)

[Practice Note on Scenario and Cell Model Reduction](#)

[Practice Note on Actuarial Guideline XXXIX](#)

[Practice Note on The Application of C-3 Phase II and Actuarial Guideline XLIII](#) and [Addendum](#)

[Practice Note on C3 Phase III](#)

Professionalism

Three standards are under development by the Actuarial Standards Board.

Actuarial Standards Exposure Draft: [Principle-Based Reserves for Life Products](#)

This actuarial standard of practice (ASOP) will provide guidance to actuaries when performing professional services in connection with establishing principle-based reserves for life insurance in compliance with the NAIC *Standard Valuation Law* and *Valuation Manual*.

Actuarial Standards Exposure Draft: [Modeling](#)

This ASOP will provide guidance to actuaries on the use and application of models.

Actuarial Standards Exposure Draft: [Credibility Procedures](#)

This ASOP will provide guidance to actuaries on credibility procedures when developing assumptions and margins.

Assumption Setting and Margins

SOA Research 2012: [Premium Persistency Study of Flexible Premium Universal Life Products Report](#)

The report examines premium persistency assumptions for flexible premium universal life products used by life insurers in pricing and cash flow testing and for GAAP/IFRS purposes.

SOA Research 2012: [Policyholder Behavior in the Tail Risk Management Section Working Group UL with Secondary Guarantee 2012 Survey Results Report](#)

The report summarizes a survey that gathered the range of assumptions actuaries use in pricing, reserving, and risk management of UL with Secondary Guarantees.

SOA Research 2010: [Lapse and Mortality Experience of Post-Level Premium Period Term Plans](#)

The report provides a study of the mortality and lapse experience of level premium term policies as they transition out of the level premium period analyzed at a granular level including, but not limited to, age, gender, risk class, premium jump, and policy size.

SOA Research 2010: [Predictive Modeling for Life Insurance](#)

SOA Research 2010: [Application of Predictive Models Techniques to Measure Dynamic Policyholder Behavior in Variable Annuity Contracts](#)

These two reports illustrate the application of predictive modeling techniques to assumptions such as lapses through several numerical examples.

SOA Research 2009: [Report on the Survey of Post-Level Premium Period Lapse and Mortality Assumptions for Level Premium Term Plans](#)

The report summarizes a survey on shock lapse and mortality assumptions used at the end of the level premium period.

SOA Research 2009: [Analysis of Methods for Determining Margins for Uncertainty under a Principle-Based Framework for Life Insurance and Annuity Products](#)

The report identifies and compares methods for determining margins for uncertainty in actuarial assumptions and examines the appropriateness of the methods under a principle-based framework for life insurance and annuity products.

SOA Research 2008: [Credibility Theory Practices Report](#)

The report summarizes the results of a study on the application and adoption of credibility theory within the life insurance and annuity industry. In addition to the report, numerical examples related to the application of credibility to company mortality and lapse data are provided in the four Excel files.

CIA Education Note 2006: [Use of Actuarial Judgment in Setting Assumptions and Margins for Adverse Deviations](#)

CIA Education Note 2006: [Margins for Adverse Deviations](#)

These reports explore the setting of assumptions and margins in GAAP Canadian financial statements.

Inputs

SOA Research 2011: [Experience Data Quality How to Clean and Validate Your Data](#)

The report provides an overview of the data cleansing and validation role specific to the life insurance experience study process.

Model Platforms (Throughputs)

SOA Research 2011: [Model Efficiency Study Results Report](#)

The report summarizes the findings of a stochastic modeling efficiency study testing six techniques for reducing the number of model points or scenarios required to achieve a given level of precision in stochastic actuarial modeling.

CIA Report 2008: [Risk Assessment Models](#)

The report discusses the role of approximations in operating models such as formula approximations, operating the model, data approximations, and the elimination of minor blocks. It discusses assumption granularity and suggests that extensive granularity may be difficult to manage, review, or validate. It discusses compression techniques.

Financial Managers Society 2013: [Choosing the Right Asset/Liability Management Model Solution and Keeping It Accurate!](#)

This paper is an objective guide for institutions in choosing the right vendor A/L model. The considerations and guidance are relevant and adaptable for life insurance companies considering a new modeling system.

Governance

SOA Research 2012: [Actuarial Modeling Controls: A Survey of Actuarial Modeling Controls in the Context of a Model-Based Valuation Framework](#)

The report summarizes an online survey on the control systems U.S. and Canadian life insurance and annuity companies have currently implemented. It evaluates the current state against the controls expected to be in place upon adoption of model-based valuation.

General

NAIC 2012: [Presentation and Analysis of Results of VM-20 Impact Study on Principle-Based Reserves for Life Insurance Products](#)

The report compares the VM-20 reserves (proposed draft dated February 28, 2011) to current statutory reserves. It also compared various sensitivities related to VM-20 assumptions.

SOA Research 2012: [2012 Asset Adequacy Testing Survey Results](#)

The report provides a perspective on practices used in asset adequacy testing.

SOA Research 2010: [Cost of Implementing a Principle-Based Framework for Determining Reserves and Capital Survey Results](#)

The report summarizes the results of a survey on issues such as planning, expected cost levels, and concerns in regard to life insurer perspectives and preparedness levels for implementing a principle-based framework for determining reserves and capital.

Secondary Resources

LIMRA Research 2013: VA Guaranteed Living Benefit Utilization 2011 Data Complete Report (to be published by the [Society of Actuaries](#) and [LIMRA](#)).

The report provides an extensive analysis on policyholder behavior and how annuity owners actually use their benefits including step-ups, cash flows, and persistency.

SOA Research Report 2013: [How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry Report](#)

SOA Research 2012: [Policyholder Behavior in the Tail: Variable Annuity Guaranteed Benefits—2011 Survey Results](#)

The survey gathers the range of assumptions actuaries use in pricing, reserving, and risk management of minimum guarantees on Variable Annuity products, such as death benefits, income benefits, withdrawal benefits, and maturity benefits.

SOA Research 2011: [Actuarial Methods for Valuing Illiquid Assets](#)

SOA Research 2008: [Analysis of Asset Spread Benchmarks](#)

Professionalism

[Actuarial Standards of Practice](#) (ASOPs)

Current ASOP's most applicable to VM-20

ASOP No 7 [Analysis of Life, Health, or Property/Casualty Insurer Cash Flows](#)

- ASOP No 18 [Long-Term Care Insurance](#)
- ASOP No 19 [Appraisals of Casualty, Health, and Life Insurance Businesses](#)
- ASOP No 22 [Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers](#)
- ASOP No 23 [Data Quality](#)
- ASOP No 38 [Using Models Outside the Actuary's Area of Expertise \(Property and Casualty\)](#)
- ASOP No 41 [Actuarial Communications](#)
- ASOP No 46 [Risk Evaluation in Enterprise Risk Management](#).

Canadian Institute of Actuaries

- [Educational Note: Guidance for the 2012 Valuation of Insurance Contract Liabilities of Life Insurers](#)
- [Memorandum to the Appointed Actuary on the Report on the Valuation of Life Insurance Policy Liabilities](#)
- [Educational Note: Valuation of Universal Life Insurance Contract Liabilities \(February 2012\)](#)
- [Research Paper: Calibration of Equity Returns for Segregated Fund Liabilities \(February 2012\)](#)
- [Educational Note: Reflection of Hedging in Segregated Fund Valuation \(May 2012\)](#)
- [Educational Note: Investment Return Assumptions for Non-Fixed Income Assets for Life Insurers \(March 2011\)](#)
- [Research Paper: IFRS Disclosure Requirements for Life Insurers](#)
- [Valuation of Gross Policy Liabilities and Reinsurance Recoverables](#)
- [Report from the Task Force on Segregated Fund Liability and Capital Methodologies](#)
- [Mortality Improvement Research Paper 2010](#)
- [Considerations in the Valuation of Segregated Fund Products](#)
- CLIFR published the [Mortality Improvement Research Paper](#)
- [Valuation of Group Life and Health Policy Liabilities](#)
- [Report of the Task Force on Segregated Fund Liability and Capital Methodologies](#)
- [Calibration of Stochastic Interest Rate Models Phase I](#)
- [Approximations to Canadian Asset Liability Method \(CALM\)](#)
- [Aggregation and Allocation of Policy Liabilities](#)
- [Standards of Practice—Practice-Specific Standards for Insurance](#)
- [Final Revised Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health \(Accident and Sickness\) Insurance \(Subsection 2350\) Relating to Mortality Improvement](#)

Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350).

[Practice-Specific Standards for Insurance, Incorporation of Standard Wording for Fairness Opinions \(Subsection 2460\)](#)

[Revised Exposure Draft to Revise the Standards of Practice—Dynamic Capital Adequacy Testing—Section 2500](#)

[Notice of Intent Regarding Standards of Practice for Modelling—A New Section Added to the General Section of the Standards of Practice Issued September 2011](#)

[Notice of Intent – Reporting of Assumptions, Margins, Methods and Related Rationales Issued June 2012](#)

Institute and Faculty of Actuaries:

[Board for Actuarial Standards. Technical Actuarial Standard M: Modeling \(TASM\)](#)

[Guidance Note 47: Stochastic Modelling for Life Insurance Reserving and Capital Assessment](#)

International Association of Insurance Supervisors (IAIS)

[Guidance Paper No. 2.2.6: On the Use of Internal Models for Regulatory Capital Purposes](#)

[IAIS Standard on Disclosures Concerning Technical Risks and Performance for Life Insurers \(October 2006\)](#)

[IAIS Towards a Common Structure and Common Standards for the Assessment of Insurer Solvency: Cornerstones for the Formulation of Regulatory Financial Requirements \(October 2005\)](#)

[IAIS Insurance Core Principles and Methodology \(October 2003\)](#)

[IAIS Principles on Capital Adequacy and Solvency \(January 2002\)](#)

[IAIS Supervisory Standard on On-Site Inspections \(October 1998\)](#)

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A.1 Glossary and Abbreviations

Business requirements—*What* must be delivered to meet the business’s objectives; requirements are not the objectives, features, or *hows*

Day-1 (or Day-2) deliverables— What is to be delivered on or by a scheduled day; a means to prioritize what is needed when and divide into phases

Gap analysis—A technique that businesses use to determine what steps need to be taken in order to move from its current state to its desired, future state; also called need-gap analysis, needs analysis, and needs assessment

Granularity—The extent to which a model contains separate components such as cells, or assumptions that vary by cell or time intervals

Intelligence—The transformation of raw data and information into various degrees of meaningful and useful information for decision-making purposes

Initiatives—Specific projects undertaken to achieve specific objectives

Model(s)—A collection of programs, modules and systems that calculate, adjust, or modify values (for the purpose of obtaining information or intelligence often used to make business decisions)

Model systems—A set of software and applications in which the models reside

Plan (verb)—To prepare sketches or to plan for a work to be executed or built

Road Map—Conveys planning information identifying what, how much, who, when, and how; a high-level plan

Practices—Activities, methods, procedures, processes, rules, competencies, and capabilities collectively used by a company in the pursuit of its objectives

Requirements—What must be delivered to meet objectives; requirements are not the objectives, features, or *hows*

Scoping—The preliminary work to formulate a Road Map

Value chain—A related set of activities that increase the usefulness (value) of the products or services of a firm (value-added activities)

Abbreviations

DET	Deterministic Exclusion Test	PBA	Principle-Based Approach
DPA	Deferred Premium Asset	SG	Secondary Guarantee
DR	Deterministic Reserve	SET	Stochastic Exclusion Test
ET	Exclusion Test	SERT	Stochastic Exclusion Ratio Test
IUL	Index Universal Life	SR	Stochastic Reserve
LTC	Long-Term Care	UL	Universal Life
NPR	Net Premium Reserve	ULSG	Universal Life with Secondary Guarantees
ORSA	Own Risk and Solvency Assessment	VM	Valuation Manual
P/L	Profit/Loss	VUL	Variable Universal Life

A.2 Scoping Guide Step 3: Engagement Decision Tree

The **Vroom-Yetton-Jago Model** enables leaders to examine situations to determine which of five styles/levels of involvement to engage associates based on seven questions regarding decision quality, commitment, problem information, and decision acceptance.

The model enables leaders to examine situations to determine which of five styles/levels of involvement to engage associates:

AI: Manager (M) makes own decision using readily available info.

AII: M collects required info from associates (A), then makes decision alone. Problem or decision may or may not be provided; A do not generate or evaluate alternatives.

CI: M shares problem to relevant A one by one requesting input. Afterward, makes decision alone; unclear if decision reflects A input.

CII: M shares problem to relevant A as a group and obtains their ideas and suggestions. Afterward makes decision alone. A input may or may not be reflected.

GII: M discusses problem with A in group setting. They work together to generate and evaluate alternatives and agree on solution. M facilitates and provides oversight. M does not force own idea on group and will accept and implement a group solution.

Autocratic Consultative Group-based.

There are seven questions on decision quality, commitment, problem information, and decision acceptance:

- A Is there a quality requirement (is it worth working to find best solution or will any number work reasonably well)?
- B Do I have sufficient info to make a high-quality decision?
- C Is the problem structured (do I know the questions to ask and where to look for relevant information)?
- D Is acceptance by associates critical to effective implementation?
- E If I were to make the decision myself, would it be accepted?
- F Do the associates share the organizational goals to be attained in solving this problem?
- G Is conflict among associates likely in preferred solutions?

Below is the decision tree:

