MEETING MATERIALS PACKET

LIFE ACTUARIAL (A) TASK FORCE (4)

August 6, 2020

NAIC SPRING NATIONAL MEETING

Virtual Meeting
August 6, 2020

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2020 Summer National Meeting  
Virtual Meeting  

LIFE ACTUARIAL (A) TASK FORCE  
Thursday, August 6, 2020  
1:00 – 3:00 a.m. ET / 12:00 – 2:00 p.m. CT / 11:00 a.m. – 1:00 p.m. MT / 10:00 a.m. – 12:00 p.m. PT  

ROLL CALL  

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<tr>
<td>Kent Sullivan, Chair</td>
<td>Mike Boerner</td>
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<td>Jillian Froment, Vice Chair</td>
<td>Peter Weber</td>
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<tr>
<td>Jim L. Ridling</td>
<td>Steve Ostlund</td>
<td>Alabama</td>
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<tr>
<td>Ricardo Lara</td>
<td>Perry Kupferman</td>
<td>California</td>
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<tr>
<td>Michael Conway</td>
<td>Eric Unger</td>
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<tr>
<td>Andrew N. Mais</td>
<td>Wanchin Chou</td>
<td>Connecticut</td>
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<tr>
<td>Robert H. Muriel</td>
<td>Bruce Sartain</td>
<td>Illinois</td>
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<tr>
<td>Stephen W. Robertson</td>
<td>Karl Knable</td>
<td>Indiana</td>
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<tr>
<td>Doug Ommen</td>
<td>Mike Yanacheak</td>
<td>Iowa</td>
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<tr>
<td>Vicki Schmidt</td>
<td>Nicole Boyd</td>
<td>Kansas</td>
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<td>Steve Kelley</td>
<td>Fred Andersen</td>
<td>Minnesota</td>
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<tr>
<td>Chlora Lindley-Myers</td>
<td>William Leung</td>
<td>Missouri</td>
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<tr>
<td>Bruce R. Ramge</td>
<td>Rhonda Ahrens</td>
<td>Nebraska</td>
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<tr>
<td>Marlene Caride</td>
<td>Seong-min Eom</td>
<td>New Jersey</td>
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<tr>
<td>Russell Toal</td>
<td>Mark Hendrick</td>
<td>New Mexico</td>
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<tr>
<td>Linda A. Lacewell</td>
<td>Bill Carmello</td>
<td>New York</td>
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<tr>
<td>Glen Mulready</td>
<td>Andrew Schallhorn</td>
<td>Oklahoma</td>
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<tr>
<td>Todd E. Kiser</td>
<td>Tomasz Serbinowski</td>
<td>Utah</td>
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<tr>
<td>Scott A. White</td>
<td>Craig Chupp</td>
<td>Virginia</td>
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</tbody>
</table>

NAIC Support Staff: Reggie Mazyck/Eric King  

AGENDA  

12:00 – 2:00 p.m.  1. Hear an Update on the Yearly Renewable Term (YRT) Field Test—Jason Kehrberg (American Academy of Actuaries [Academy] Life Practice Council), Chris Whitney (Oliver Wyman), Jennifer Frasier (NAIC), and Scott O’Neal (NAIC)
Results and Analysis for Field Test and Interpretation Survey
Results and analysis for field test and interpretation survey

LONG-TERM SOLUTION

(YRT & VM-20)
QUALIFICATIONS, ASSUMPTIONS, AND LIMITING CONDITIONS

Oliver Wyman was engaged by the American Council of Life Insurers, the American Academy of Actuaries and the National Association of Insurance Commissioners to support an industry field test being conducted to aid the NAIC Life Actuarial (A) Task Force in the selection of a long-term solution for the treatment of non-guaranteed reinsurance under PBR.

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01 Executive summary
02 Review of proposed solutions
03 Field test results and analysis
04 Interpretation survey results and additional analysis

Appendix A: Supporting reports and presentations
A.1: Academy reports
A.2: Prior reports

Appendix B: Model design and assumptions
B.1: Prior reports

Appendix C: Supplemental results
C.1: Field test results and analysis
C.2: Interpretation survey results and additional analysis

Appendix D: Project team

Executive summary 01
Review of proposed solutions 02
Field test results and analysis 03
Interpretation survey results and additional analysis 04
This report contains results and additional analysis for the industry field test and interpretation survey which will aid the NAIC Life Actuarial (A) Task Force ("LATF") in the selection of a longer-term solution for the treatment of non-guaranteed reinsurance under PBR.

Following the delivery of this report, Oliver Wyman and NAIC staff are available to answer questions.

Executive summary

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Executive summary

Section Contents and objectives

02 Review of proposed solutions

- Contains a description and representative language from the three amendment proposals (APFs) evaluated in the field test and interpretation survey (APF 2019-40, 41 and 42).
- Objective is to provide a broader view of long-term solutions on a consistent basis (e.g., perspectives).

03 Field test results and analysis

- Contains results of industry field test and additional analysis performed using the representative PBR model.
- Objectives are to build understanding of field test scenarios and detail the refinements made to the representative PBR model informed by field test responses.
- Range of variation in results contains results of industry field test and additional analysis performed using representative PBR model to confirm the integrity of submissions and understanding of the interpretation survey results.

04 Interpretation survey results and additional analysis

- Contains results of interpretation survey and additional analysis performed using the representative PBR model in light of the range of responses received. Analysis includes both direct writers and reinsurers as well as the potential for asymmetries in reserves.
- Objectives are to provide a broader view of long-term solutions on a consistent basis (e.g., perspectives).
### Executive Summary: Takeaway Coverage

1. Reinsurer reaction scenarios can produce reserve credits in excess of ½ Cx. (Report from 2019 Fall NAIC meeting and supplemental analysis. See Appendix A.2)

2. It is important to look at long-term projections of reserves when evaluating the impact of modeling complexity, variation in reserves and other long-term solutions.

3. Differences in reserve credits and assumed reserves under PBR are primarily driven by the relationship between the current scale of YRT premiums and PBR mortality (anticipated experience and the level of margin).

4. Differences in modeled reserves are minimized when a mechanical approach to reinsurance is used by both parties. Reinsurance modeling approaches and survey results suggest that mechanical approaches may be used to minimize the impact of reinsurance on reserves. (Report from 2019 Fall NAIC meeting and supplemental analysis. See Appendix A.2)

5. Variation in surveyed approaches points to several considerations including level of prescription.

6. Differences in ceded reserve credits and assumed reserves are minimized when a mechanical approach to reinsurance is used by both parties.
## COMPARISON OF PROPOSED SOLUTIONS

This comparison is informed by results and analyses contained in this report.

<table>
<thead>
<tr>
<th>Level of prescription</th>
<th>Modeling complexity</th>
<th>Variation in results</th>
<th>Potential for asymmetry</th>
<th>Potential APF revisions</th>
</tr>
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Note: The comparison table above illustrates the differences in level of prescription, modeling complexity, variation in results, potential for asymmetry, and potential APF revisions among the proposed solutions.
02 REVIEW OF PROPOSED SOLUTIONS
Representative Language

**Model YRT premiums using anticipated experience with margins based on clarified modeling principles/guidance and actuarial judgment.**

**Note: VM-20 Section 9.B.2 applies such that greater uncertainty in the anticipated experience requires a larger margin.**

The company shall base its company and counterparty action assumptions relating to YRT reinsurance consistent with the moderately adverse environment as applicable to the valuation of all life policyholders (APF 2019-40, Section 8.5).

APF 2019-40

**YRT premiums**

Review of proposed solutions
Historical rate increases and/or relationship with mortality, with consideration for treaty provisions, scale and the company’s anticipated experience mortality, with consideration for treaty provisions, non-guaranteed reinsurance premiums are based on the relationship between the current premium and claims.

The company shall use best estimate assumptions with no implicit or explicit margins, except margins pursuant to section 8.C.16 through section 8.C.18, as the prudent estimate assumptions for YRT reinsurance premiums paid and YRT reinsurance claims received, using the following procedure:

a. Use the reinsurance rates and provisions from the relevant reinsurance agreement as the initial prudent estimate assumption for YRT reinsurance premiums paid, and project future reinsurance rate increases and decreases using what the company actually expects will occur, based on treaty provisions, past reinsurance experience assumptions, and ongoing relationship with the reinsurer.

b. The mortality rates used to determine the prudent estimate assumptions for YRT reinsurance claim settlements shall equal the company’s anticipated experience mortality assumptions adjusted to reflect the company’s best estimate of mortality improvement rate, and no ongoing relationship with the reinsurer.

c. Use the reinsurance rates and provisions from the relevant reinsurance agreement as the initial prudent estimate assumptions for YRT reinsurance claims received, using the following procedure:

The company’s best estimate of mortality improvement assumptions includes:

- Claims determined using the company’s anticipated experience mortality assumptions that will occur.
- Premises determined using current YRT premium scale with projected adjustments based on what the company actually expects will occur.

Representative language (APF 2019-41 section 8.C.8)
Non-Guaranteed Reinsurance premiums are modeled as the current scale plus a margin, which is developed based on prescribed inputs, with some flexibility to make adjustments to reflect contract.

The formula for the prescribed margin (additive to current rates) from APF 2019-42 is summarized below:

\[ f(x) = \chi \cdot \left( \frac{r \cdot \text{YRT rate}}{1 - r} \right) \]

where:
- \( f(x) \) is the prescribed margin for YRT premiums
- \( \chi \) is the credibility experience assumption for YRT premiums
- \( r \) is the current YRT rate
- \( \text{YRT rate} \) is the current year rate
- \( \text{YRT premium} \) is the current year premium

**Provisions**

- Companies that have greater than the minimum credibility/SDP will use their own credibility, but companies with lower credibility/SDP will use the minimum.

**Reinsurance Premium Margin Development**

- Small companies also assume a minimum level of credibility and sufficient data period to avoid bias against mortality.
- Use current YRT premium rates, plus a prescribed margin for non-Guaranteed margin, which is based on the difference between baseline mortality and company mortality, and a prudent estimate mortality calculated using a minimum of 80% credibility and sufficient data period.
03

FIELD TEST RESULTS AND ANALYSIS
Participation requirements

Submissions for ULSG:
8
Submissions for Term:
7
Participating reinsurers:
0
Participating entities:
11
Entities invited to participate:
187

Submission requirements

1. One Term submission and one ULSG submission did not include projected reserves
2. Source: 2018 Individual life insurance sales
3. One Term submission and one ULSG submission did not include projected reserves

Field test scenarios

- Action A – No change in YRT rates and counterparty actions
- Action B – Prudent estimate YRT rates and counterparty actions
- Action C – Prudent estimate YRT rates after reaching a loss trigger
- Action D – Prudent estimate YRT rates after consecutive years of loss trigger

Mortality assumption credibility (%)

- Included
- Not included
- 0–50%
- 50–80%
- > 80%

Assumption unlocking

- Included
- Not included

Years of loss trigger

- 5, 10, 15 and 20 years

Field test results and analysis

- Individual life sales (rank):
  1–5 6–20 21+

- Mortality assumption credibility (%):
  0%–50% 50%–80% > 80%

- Assumption unlocking:
  Included Not included

OVERVIEW

Sophisticated modeling, extensive analysis and resource constraints led to low participation in the field test. However, participating companies are broadly distributed as highlighted below.
Refinements to Representative PBR Model

Field test submissions were used to refine the granularity of certain methodology analysis dimensions in the representative PBR model. The refined model was used to confirm the integrity of submissions and provide insights into the variability in results.

Observations:
- A majority of submissions (all but one participant) did not reflect unlocking of mortality up to future valuation dates.

Properties of reinsurance:

Observation:
Submissions reflected a range of underlying YRT reinsurance parameters; in particular the portion of business reinsured and the relationship between the current scale of rates and anticipated mortality.

Model refinements:
- Normalize reinsurance reserve credits per 1,000 of ceded NAAR.
- Adjust YRT rate scales to reflect key relationships observed in participant submissions.

Properties of mortality:

Observation:
Submissions reflect a range of anticipated mortality.

Model refinements:
- Model YRT scales based on relationships observed in field test submissions.
- Utilize two credibility scenarios in Representative PBR model, reflecting two levels of credibility observed in field test submissions.

Properties of reserves:

Observation:
A majority of submissions (all but one participant) did not reflect unlocking of mortality up to future valuation dates.

Model refinements:
- Turn off mortality assumption unlocking.
### Dimension Field test results and analyses

#### Reserves

- Turned off dynamic assumption unlocking
- Utilized own company YRT rate scales
- Relationship between current scale of YRT rates is greater

#### Mortality

- Credibility: 40–100% (See table on page 12 for further details)
- Developed two credibility scenarios based on analysis of field test responses:
  - High Credibility: 100% credibility (Limited Fluctuation method)
  - Low Credibility: 50% credibility (Limited Fluctuation)

#### Reinsurance

- Only one participant included unlocking of the mortality assumption
- Mortality assumption (sufficient data period) on future valuation dates and anticipated mortality experience was examined based on information provided in field test submissions
- Relationship between current scale of YRT rates and anticipated mortality experience was developed:
  - Lower YRT scale: Current scale of YRT rates is in line with anticipated mortality experience excluding FMI
  - Baseline YRT scale: Current scale of YRT rates is greater than anticipated mortality experience without FMI

#### Refinements to Representative PBR model

- Field test submissions
- Developed three separate rate scales for each product

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**Table:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Detailed Refinements to Representative PBR model</th>
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<tr>
<td>Reserves</td>
<td>Turned off dynamic assumption unlocking</td>
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<tr>
<td>Mortality</td>
<td>Utilized own company YRT rate scales</td>
</tr>
<tr>
<td>Reinsurance</td>
<td>Relationship between current scale of YRT rates and anticipated mortality experience was developed</td>
</tr>
</tbody>
</table>

In the following table, along with details on field test submissions used to inform them, further details on refinements made to methodology and analysis dimensions in the representative PBR model are shown.
**BASELINE | ULSG RESULTS**

The representative PBR model explains the variance in impacts of reinsurance on modeled reserves observed in field test submissions.

- Coverage range (Representative PBR model) - Lower bound is "Lower YRT scale" with high credibility; Upper bound is "Higher YRT scale" with high credibility.
- Lower bound of results (largest "reserve credit") from upper credible range.
- Mid-point of results from representative PBR model is "Baseline YRT scale" with high credibility (dark blue line).
- Deviation driven primarily by attained age and issue month.

Test submissions present the range combinations of rate scales and levels of credibility.

Field test results legend:
- Shaded blue range represents the range of results.
- Upper bound of results (largest "reserve credit") from upper credible range.
- Mid-point of results from representative PBR model is "Baseline YRT scale" with high credibility (dark blue line).
- Deviation driven primarily by attained age and issue month.

Commentary:
1/2 CX

2. Gross DR – Net DR (per 1000 of projected ceded NAAR)

2. Gross DR – Net DR (per 1000 of projected ceded NAAR)

Derivations of the unitized reduction to DR can be found in Appendix A.
Action A and therefore results are the same as the baseline in that they reflect the anticipated counterparty actions such as default, recapture and other terminations, and that range of results is wider compared to other field test scenarios, as there are no adjustments to YRT rates for default, recapture or other terminations. Action A is to model current YRT rates for all projection years; apply the APF only with regards to other counterparty actions such as default, recapture or other terminations. Range of results is wider compared to other field test scenarios, as there are no adjustments to YRT rates for default, recapture or other terminations.

Some field test results reflected recapture in later years which reduced reserve credits in later durations. Limited to the inclusion of anticipated counterparty actions such as default, recapture and other terminations, Action A produces only a slight shift in the impact of reinsurance on modeled reserves relative to the baseline, as it is.

Commentary

- Action A is to model current YRT rates for all projection years; apply the APF only with regards to other counterparty actions such as default, recapture or other terminations.
- Range of results is wider compared to other field test scenarios, as there are no adjustments to YRT rates for default, recapture or other terminations. Action A is to model current YRT rates for all projection years; apply the APF only with regards to other counterparty actions such as default, recapture or other terminations.
The impact of reinsurance on modeled reserves is dependent on the range of participant prudent estimates used in modeling counterparty actions.

**Commentary**

- Action B is to model a prudent estimate of all counterparty actions (which includes changes to YRT rates); apply the APF with no additional restrictions or guidance.
- The representative PBR model includes a margin to reinsurance premiums equal to the difference between best estimate mortality (including future mortality improvement) and valuation mortality.
- Various approaches in field test submissions to incorporate margins to YRT premiums were observed, resulting in higher DR “reserve credits” compared to the representative PBR model. Approaches included grading to an increased premium over time, increasing premiums after a certain duration, and increasing premiums after a loss ratio is triggered.
Applying a "loss ratio" trigger to determine the timing of reinsurer reaction leads to a narrower range of DR reserve credits relative to the baseline, but may be inconsistent with contractual terms.

Commentary

- The lower bound of the coverage range is similar compared to the baseline, but upper bound is substantially reduced.
- The trigger is never reached for the "Higher YRT scale" (upper bound).
- The "loss ratio" trigger is reached earlier in the projection for "Lower YRT scale" (lower bound) compared to "Baseline YRT scale" and mortality after reaching the loss ratio trigger.
- The "loss ratio" trigger is reached earlier in the projection for "lower YRT scale" compared to "Baseline YRT scale" and may be inconsistent with contractual terms.
- In the representative PBR model, margins were applied based on the difference between the valuation mortality and best estimate.
- The "loss ratio" trigger is reached earlier in the projection for "lower YRT scale" compared to "Baseline YRT scale" and may be inconsistent with contractual terms.
- The lower bound of the coverage range is similar compared to the baseline, but upper bound is substantially reduced.

Field test results and analysis

APF 2019-40 (ACTION C) | ULSG RESULTS
Commentary

Field test results and analysis

APF 2019-40 (ACTION D) | ULSG RESULTS

3.10 Gross DR – Net DR (per 1000 of projected ceded NAAR)

Action D is to model prudent estimate of rate changes only after reaching “consecutive years of loss” trigger equal to 5 years. The application of a “consecutive losses” approach to determine the timing of reinsurer reaction reduces variability in the impact of reinsurance relative to the baseline, albeit to a lesser extent than the application of a "loss ratio" trigger that reinsurance has on modeled reserves relative to the baseline.

Prudent estimate margins are not applied ubiquitously, therefore the results are less dependent on the relationship of current YRT rates and valuation mortality during the projection.

Similar to Action C, application of prudent estimates are driven by the relationship between YRT rates and valuation mortality, losses are calculated by reviewing annual projected reinsurance cash flows from the assuming company perspective.

Rates and valuation mortality compared to other solutions

Applying a "consecutive losses" approach to determine the timing of reinsurer reaction reduces variability in the impact of reinsurance relative to the baseline, albeit to a lesser extent than the application of a "loss ratio" trigger that reinsurance has on modeled reserves relative to the baseline.

Applying a "consecutive losses" approach to determine the timing of reinsurer reaction reduces variability in the impact of reinsurance relative to the baseline, albeit to a lesser extent than the application of a "loss ratio" trigger that reinsurance has on modeled reserves relative to the baseline.
APF 2019-41 | ULSG RESULTS

Introducing future mortality improvement to the projected claims reduces reinsurance gains, given the current scale of reinsurance premiums is held constant.

3.11 Gross DR – Net DR (per 1000 of projected ceded NAAR)  
0.0% FMI

3.12 Gross DR – Net DR (per 1000 of projected ceded NAAR)  
0.5% FMI

3.13 Gross DR – Net DR (per 1000 of projected ceded NAAR)  
1.0% FMI

Commentary
- Variation in YRT rate scales and credibility impact results in a similar manner.
- Mortality improvement is applied for 15 years.
- 50bps of incremental mortality improvement reduces the DR “reserve credit” to close to zero in initial projection years for the neutral rate scale.
- The representative PBR model included margins in addition to YRT premiums as a modeling simplification rather than a pure interpretation of the APF.
When a margin is defined as the relationship between net and projected experience and best estimate mortality, "higher credit" with no future mortality improvement

5 years of incremental mortality improvement reduces the reserve credit by roughly 50% (relative to the "reserve credit" with no future mortality improvement) and length

APF 2019-41 and APF 2019-42 produce similar results, with

APF 2019-41 & ULSG RESULTS

Similar to APF 2019-41, increasing the level of future mortality improvement decreases reserve credits
Reinsurer reaction scenarios can produce reserve credits in excess of ½ Cx

- ½ Cx represents the cost of reinsurance that corresponds to the period for which the reinsurance premium has been paid, but not yet earned by the reinsurer, with no provision for reinsurance beyond the paid to date.

Full reinsurer reaction scenarios tested allow for:
- Differences between evolution of mortality and reinsurance premium payment dates, contractual provisions around return of unearned reinsurance premium and other mechanical differences due to VM-20 requirements (e.g., differences in starting assets and resulting earned rate).

It is important to look at long-term projections of reserves when evaluating the impact of reinsurance modeling approaches:
- The level of margin in mortality as compared to best estimate changes at future valuation dates, due to unlocking of mortality improvement and extending the sufficient data period.
- As the business ages, higher mortality and shorter projection horizons will change the impact of reinsurance on reserves at future valuation dates.

Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons:
- Reserves between direct writers and reinsurers will not be mirrored, primarily due to differences in valuation assumptions (including changes to non-guaranteed YRT premiums).
- Other drivers include the mechanics of computing final PBR reserves, and reinsurers aggregating results across multiple treaties and multiple cedants.
- Differences between ceded and assumed reserves are reduced when adjustments to YRT premiums are based on the level of mortality margin specific to each party.

Differences in modeled reserves are primarily driven by the relationship between the current scale of reinsurance premiums and mortality.
- Observed differences in the relationship between the current scale of reinsurance premiums and mortality:
  - Level of mortality margin used to establish reinsurance.
  - Differences between expected and assumed mortality are reduced when adjustments to YRT premiums are based on the level of mortality margin.

Additional key takeaways from analysis of field test results are highlighted below in addition to those previously established.

- Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons:
  - Level of mortality margin used to establish reinsurance.
  - Differences between expected and assumed mortality are reduced when adjustments to YRT premiums are based on the level of mortality margin.

- Field test results and analysis...

Additional key takeaways from analysis of field test results are highlighted below in addition to those previously established.

- Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons:
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- Field test results and analysis...

Additional key takeaways from analysis of field test results are highlighted below in addition to those previously established.

- Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons:
  - Level of mortality margin used to establish reinsurance.
  - Differences between expected and assumed mortality are reduced when adjustments to YRT premiums are based on the level of mortality margin.
INTERPRETATION SURVEY RESULTS AND ADDITIONAL ANALYSIS
Survey provided approximately 25% of the industry measured by total face amount on new business

Survey usage
• Collected separate responses for different treatment by treaty type
  (i.e., PBR) mortality with specified parameters
• Supplement and broaden range of practice outside of the participation of field test responses
  We used the results of the survey to develop criteria to compare the APFs
• Respondents were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
  Options included:
  – No change to YRT premiums
  – Increasing rates by a specified amount of the prescribed mortality improvement after a specified period of time and every X years thereafter, with and without future mortality improvement
  – Increasing rates by the difference between current scale and prudent estimate (i.e., PBR) mortality, with specified parameters
• Collected separate responses for different treatment by treaty type
  and peers within a specific group, with parameters included:
  • Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

High level description of questions
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
  Options included:
  – No change to YRT premiums
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  – Increasing rates by the difference between current scale and prudent estimate (i.e., PBR) mortality, with specified parameters
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

Responses
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

Interpretation survey results and additional analysis
• The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

BACKGROUND AND PURPOSE
The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

Interpretation survey results and additional analysis
• The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

Survey purpose
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High level description of questions
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
  Options included:
  – No change to YRT premiums
  – Increasing rates by a specified amount of the prescribed mortality improvement after a specified period of time and every X years thereafter, with and without future mortality improvement
  – Increasing rates by the difference between current scale and prudent estimate (i.e., PBR) mortality, with specified parameters
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

Responses
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

Interpretation survey results and additional analysis
• The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

BACKGROUND AND PURPOSE
The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

Interpretation survey results and additional analysis
• The interpretation survey asked participants to detail how they would implement each of the proposed solutions.

Survey purpose
• Collected separate responses for different treatment by treaty type
  (i.e., PBR) mortality with specified parameters
• Supplement and broaden range of practice outside of the participation of field test responses
  We used the results of the survey to develop criteria to compare the APFs
• Respondents were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
  Options included:
  – No change to YRT premiums
  – Increasing rates by a specified amount of the prescribed mortality improvement after a specified period of time and every X years thereafter, with and without future mortality improvement
  – Increasing rates by the difference between current scale and prudent estimate (i.e., PBR) mortality, with specified parameters
• Collected separate responses for different treatment by treaty type
  and peers within a specific group, with parameters included:
  • Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.

High level description of questions
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
  Options included:
  – No change to YRT premiums
  – Increasing rates by a specified amount of the prescribed mortality improvement after a specified period of time and every X years thereafter, with and without future mortality improvement
  – Increasing rates by the difference between current scale and prudent estimate (i.e., PBR) mortality, with specified parameters
• Several options were provided for projecting changes to YRT rates. Participants were asked to select the option that best fits their intended approach.
<table>
<thead>
<tr>
<th>Survey Parameters</th>
<th>Model approach not adequately captured by other choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinsurer reaction</td>
<td></td>
</tr>
<tr>
<td>Assumption for projected YRT premium rate increases</td>
<td></td>
</tr>
<tr>
<td>Frequency of rate changes</td>
<td></td>
</tr>
<tr>
<td>Initial trigger changes</td>
<td></td>
</tr>
<tr>
<td>Break-even</td>
<td>6</td>
</tr>
<tr>
<td>Reactive</td>
<td>5</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requested</th>
<th>Other</th>
<th>Break-even</th>
<th>Reactive</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1234567</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Frequency of rate changes</td>
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<td>8</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Initial trigger changes</td>
<td>1234567</td>
<td>8</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Assumption for projected YRT premium rate increases</td>
<td>1234567</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

For each group of reinsurance agreements, participants were asked to provide standardized responses on how YRT premium rates would be adjusted based on language presented in each proposal. Interpretation survey results and additional analysis.
Reinsurer reaction

- None 19%
- Reactive 40%
- Break-even 25%
- Other 16%

- 100% of prescribed mortality margin after 1 year and every year thereafter
- Include implicit future mortality improvement margin

Reinsurer reaction illustrated

Modeling approaches illustrated

- Interpretation survey results and additional analysis

SURVEY COMMENTARY

Range of responses

- Responses ranged from straightforward (reactive or break-even) to complex
- Complex responses were often associated with None and Other
- Complex responses were associated with largest variance across survey options
- Largest percentage selecting “Other” – Examples: recapture at certain periods, utilize a loss trigger

- 16% Other
- 25% Break-even
- 40% Reactive
- 19% None
4.1 Pre-reinsurance DR – Post-reinsurance DR (Projected reserve amount)

4.3 Pre-reinsurance DR – Post-reinsurance DR (Projected reserve amount)

A fully reactive reinsurance margin produces the largest post-reinsurance DR relative to other options.

Interpretation survey results and additional analysis

APF 2019-40 | ULSG
Pre-reinsurance DR (projected reserve amount)

- High credibility

Post-reinsurance DR (projected reserve amount)

"Baseline YRT scale" and high credibility

Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

"Baseline YRT scale" and high credibility

Valuation dates due to a higher baseline YRT scale than ULSG

No change in rates scenario produces the highest modeled "reserve credit" for Term but is smaller than ½ cx for most

**APF 2019-40 | TERM**

Interpretation survey results and additional analysis
Reinsurer reaction:

- None 55%
- Reactive 17%
- Break-even 18%
- Other 10%

Modeling approaches illustrated:

- Increase YRT premiums by 100% of the difference between current YRT premium and prescribed mortality immediately and each year thereafter.
- Reinsurance cash flows (premiums and claims) projected separately using best estimate mortality including future mortality improvement.

Range of responses:

- None 55%
- Reactive 17%
- Break-even 18%
- Other 10%

Survey commentary:

- Most responses were either None or Break-even.
- These responses generally included a comment regarding intent to adjust claims in lieu of premiums.
- Many respondents indicated the need for multiple models or model runs to apply this APF to reflect best estimate mortality for reinsurance cash flows and VM-20 mortality for all other cash flows.
- Some respondents expressed concern with consistency between using one projection using prudent assumptions and a separate one using best estimate assumptions.

Range of responses:

- None 55%
- Reactive 17%
- Break-even 18%
- Other 10%
4.7 Pre-reinsurance DR (projected reserve amount)

High credibility

4.8 Post-reinsurance DR (projected reserve amount)

"Baseline YRT scale" and high credibility

4.9 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

"Baseline YRT scale" and high credibility

The relationship between YRT rates and anticipated mortality minimizes the impact of interpretation differences. This is because Option 1 uses anticipated experience assumptions and reinsurance premiums are closely aligned with benefits (nearly break-even) and reinsurance is break-even under Option 5. Interpretation survey results and additional analysis
4.10 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

Interpretation survey results and additional analysis

Similar to UL56, the no change in rate scenario produces the largest "reserve credit", but it is considerably smaller than 2/3 Cx.
Reinsurer reaction

- None 1%
- Reactive 64%
- Break-even 29%
- Other 6%

Modeling approaches illustrated

- Increase YRT premiums by 100% of prescribed mortality immediately and each year thereafter
- Increase YRT premiums by 100% of prescribed mortality margin immediately and each year thereafter
- Increase YRT premiums by 100% of prescribed mortality margin and include implicit future mortality improvement
- Increase YRT premiums by 100% of prescribed mortality margin and include implicit future mortality improvement in implicit margin
- Increase YRT premiums by 100% of prescribed mortality margin and include implicit future mortality improvement in implicit margin
- Increase YRT premiums by 100% of prescribed mortality margin and include implicit future mortality improvement in implicit margin

Range of responses

- Increase YRT premiums by 100% of the difference between current YRT premium and prescribed mortality immediately and each year thereafter
- Increase YRT premiums by 100% of prescribed mortality margin after 1 year and every year thereafter
- Including 10 years of future mortality improvement in implicit margin

Survey commentary

- Most responses were reactive and incorporate 100% of the prescribed margin after 1 year and every year thereafter.
- Variation in reactive responses was the number of years of mortality improvement included in the margin.
- Some responses pointed out that the prescribed solution will require a company to develop multiple sets of mortality assumptions to determine the prescribed margin.
- Given that over 35% of responses were something other than a reactive margin, the prescribed margin formula may be difficult to interpret and understand.

Interpretation survey results and additional analysis
4.13 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

Reducing the amount of implicit margin due to future mortality improvement in the development of the prescribed mortality margin decreases the net DR and increases the “reserve credit”.

Interpretation survey results and additional analysis

APF 2019-42 | ULSG
Reducing the amount of implicit margin due to future mortality improvement in the development of the prescribed mortality margin decreases the net DR and increases the "reserve credit."
4.19 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

2019-40 “Baseline YRT scale” and high credibility

4.20 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

2019-41 “Baseline YRT scale” and high credibility

4.21 Pre-reinsurance DR – Post-reinsurance DR (projected reserve amount)

2019-42 “Baseline YRT scale” and high credibility

IMPACT ON DR RELATIVE TO INTERIM SOLUTION (ULSG)

DR “reserve credit” from preceding slides with all APFs displayed on the same page

1/2 CX

Break even after 1 year (option 5)

Fully reactive after 1 year, including 10 yr MI (option 4)

Fully reactive after 1 year (option 2)

No change in rates (option 1)

Interpretation survey results and additional analysis

44
Impact on DR Relative to Interim Solution (Term)

Interpretation survey results and additional analyses
Additional key takeaways from analysis of range of interpretation survey results are highlighted below in addition to those previously established.

1. **Reinsurer reaction scenarios can produce reserve credits in excess of \( \frac{1}{2} \text{Cx} \)**
   - \( \frac{1}{2} \text{Cx} \) represents the cost of reinsurance that corresponds to the period for which the reinsurance premium has been paid, but not yet earned by the reinsurer, with no provision for reinsurance beyond the paid to date.
   - Full reinsurer reaction scenarios allow for differences between evolution of mortality and reinsurance premium payment dates, contractual provisions around return of unearned reinsurance premium, and other mechanical differences due to VM-20 requirements.

2. **It is important to look at long-term projections of reserves when evaluating the impact of reinsurance**
   - The level of margin in mortality as compared to best estimate changes at future valuation dates, due to unlocking of mortality improvement and extending the sufficient data period.
   - As the business ages, higher mortality and shorter projection horizons will change the impact of reinsurance on reserves.

3. **Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons**
   - Reserves between direct writers and reinsurers will not be mirrored, primarily due to differences in valuation assumptions (including changes to non-guaranteed YRT premiums).
   - Other drivers include the mechanics of computing final PBR reserves and reinsurers aggregating results across multiple treaties and multiple cedants.

4. **Variation in surveyed approaches points to several considerations including level of prescription, modeling complexity, and others in a long-term solution**
   - APF 2019-42 has the highest level of prescription. APF 2019-40 allows for more flexibility, however, measures to reduce the variation in results (e.g., loss ratio trigger) add additional prescription.
   - APF 2019-41 has the most complex (modeling and theoretical) as no guidance is provided on how to model reserves across field test participants.
   - APF 2019-40 has the widest range of model results, ranging from improved reserve assumptions to more complex approaches to reduce the variation in results.

5. **Precondition modeling compared to evaluation of long-term solution**
   - Observations and practical experience by the relationship between the current scale of YRT premiums and mortality are well as the level of mortality margin explain the degree of variability in impacts of reinsurance on reserves.
   - Differences in modeled reserves are primarily driven by the relationship between the current scale of reinsurance premiums and anticipated mortality.
   - Observed differences in the relationships between the current scale of ceded reserves and the level of mortality margin will be minimized, primarily due to differences in valuation assumptions.

**Details**
Observation from prior analysis: Differences in assumed reserve compared to reserve credits can be driven by PBR methodology and asymmetries caused by the formulaic floor on reserves (i.e., NPR).

Analytical adjustment: Analyses focused on the impact of reinsurance on the DR to remove potential impacts driven by asymmetries caused by the formulaic floor on reserves. Reinsurance can drive credits can be driven by PBR methodology compared to reserve credits and assumed reserves.

Observation: Differences in assumptions between cedant and assuming perspectives for modeled reserves are the primary driver of differences between reserve credits and assumed reserves.

Analytical adjustment: Use consistent assumptions for both perspectives to isolate the impact of interpretation in regards to the treatment of non-guaranteed reinsurance.

Drivers of differences in reserve credits and assumed reserves:

- Most common responses and responses resulting in the largest reduction in aggregate DR from reinsurers and direct writers were compared, removing impact of ancillary differences between reserve credits and assumed reserves driven by assumptions.

Evaluation of total impact on DR (ceded and assumed): 

Impact of non-guaranteed reinsurance was compared to reserve credits and assumed reserves. Where reinsurer expenses were included, removing differences between modeled reserve credits and assumed reserves driven by assumptions can produce different impacts in reserves compared to the ceded pre and post reinsurance DR.
Combined impact to DR from both ceding and assuming companies for the most common surveyed reactions is positive; combinations of other surveyed reactions could lead to a reduction in total DR.

Interpretation survey results and additional analysis:

- **None**: 18%
- **Reactive**: 42%
- **Break-even**: 22%
- **Reinsurer reaction – Ceding company**
  - None: 18%
  - Reactive: 42%
  - Break-even: 22%
  - Other: 17%
- **Reinsurer reaction – Assuming company**
  - None: 20%
  - Reactive: 20%
  - Break-even: 60%
  - Other: 0%

Largest reduction to DR

- Differences in modeling approach result in differences between reserve credit and assumed reserve
- Some assuming companies noted that they may raise their rates to more than 100% of difference between current YRT premiums and VM-20 mortality to cover expenses and contribute to profit margins, which decreases the assuming reserves displayed in 4.19 and increases the likelihood that the NPR will dominate (e.g., \( \frac{1}{2} Cx \))
- Largest reduction to aggregate reserves based on responses is driven by direct writers applying no prudence to YRT premiums

Combined impact to total projected deterministic reserves (ULSG)

**Other**

### %

- **Break-even**: 60%
- **Reactive**: 20%
- **None**: 20%

**Reinsurer Reaction – Assuming company**

### %

- **Other**: 17%
- **Break-even**: 22%
- **Reactive**: 42%
- **None**: 18%

**Reinsurer Reaction – Ceding company**

### %

- **Other**: 18%
Reinsurer reaction – Ceding insurer

None 59%
Reactive 19%
Break-even 15%
Other 7%

Reinsurer reaction – Assuming reinsurer

None 20%
Reactive 0%
Break-even 40%
Other 40%

Impact to total projected deterministic reserves (ULSG)

-1.0
-0.5
0.0
0.5
1.0

Largest reduction to DR

• “None” reaction refers to no adjustments to premium, underlying claims are adjusted to reflect anticipated experience
• Reinsurers had similar comments as direct companies regarding the need to model reinsurance cash flows separately to properly reflect the guidance in the APF
• Largest reduction to DR is smaller than APF 2019-40 since responses did not reflect “no adjustment”

Commentary

Interpretation survey results and additional analysis

Impact of reinsurance on combined DR based on most common responses is smaller than APF 2019-40
### Most common reactions

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Ceded Credit</th>
<th>Assumed Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive</td>
<td>60%</td>
<td>None</td>
</tr>
<tr>
<td>None</td>
<td>20%</td>
<td>Reactive</td>
</tr>
<tr>
<td>Break-even</td>
<td>10%</td>
<td>Reactive</td>
</tr>
</tbody>
</table>

### Differences in calculation methodology and assumptions

- Most common reaction for both ceding and assuming companies is reactive which offsets in the absence of other reaction.
Additional key takeaways from evaluation of total impact on DR (ceded and assumed) are highlighted below in addition to those previously established.

**Details**

1. Reinsurer reaction scenarios can produce reserve credits in excess of ½ Cx.
   - ½ Cx represents the cost of reinsurance that corresponds to the period for which the reinsurance premium has been paid, but not yet earned by the reinsurer, with no provision for reinsurance beyond the paid to date.
   - Full reinsurer reaction scenarios tested allow for differences between evolution of mortality and reinsurance premium payment dates, contractual provisions around return of unearned reinsurance premium and other mechanical differences due to VM-20 requirements (e.g., differences in starting assets and resulting earned rate).

2. It is important to look at long-term projections of reserves when evaluating the impact of reinsurance modeling approaches.
   - The level of margin in mortality as compared to best estimate changes at future valuation dates, due to unlocking of mortality improvement and extending the sufficient data period.
   - As the business ages, higher mortality and shorter projection horizons will change the impact of reinsurance on reserves at future valuation dates.

3. Differences in reserve credits and assumed reserves under PBR are likely to occur for multiple reasons.
   - Reserves between direct writers and reinsurers will not be mirrored, primarily due to differences in valuation assumptions (including changes to non-guaranteed YRT premiums).
   - Other drivers include the mechanics of computing final PBR reserves, and reinsurers aggregating results across multiple treaties and multiple cedants.
   - Differences between ceded and assumed reserves are reduced when adjustments to YRT premiums are based on the level of mortality margin specific to each party.

4. Differences in modeled reserves are primarily driven by the relationship between the current scale of YRT premiums and PBR mortality (anticipated experience and the level of margin).
   - Observed differences in the relationship between the current scale of reinsurance premiums and anticipated mortality may explain the degree of variability in impacts of reinsurance on modeled reserves across test participants.
   - The prescription of triggers (APF 2019-40) and levels of future mortality improvement (APF 2019-41 and 2019-42) can result in mirrored deterministic “reserve credits” across mechanical approaches.

5. Differences in surveyed approaches point to several considerations including level of prescription, modeling complexity, variation in results and others in a long-term solution.
   - APF 2019-42 has the highest level of prescription. APF 2019-40 allows for more flexibility; however, measures to reduce the variation in results (e.g., “loss ratio” trigger) add additional prescription.
   - APF 2019-41 has the most complexity (modeling and theoretical) as it requires projecting YRT premium and claim cashflows using a separate mortality assumption.

6. Differences in ceded “reserve credits” and assumed reserves are minimized when a mechanical approach to reinsurance is used by both parties.
   - When both ceding companies and assuming companies have the same assumptions and methodologies, a reactive approach under APF 2019-42 can result in mirrored deterministic “reserve credits”.
### Field Test Solutions

Dimensions for comparison were established over the course of the project.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description and comments</th>
<th>Key Supporting Analyses</th>
<th>Potential APF Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some dimensions have clear ideal outcomes (e.g., modeling complexity) while other dimensions will need to be weighed.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description and comments</th>
<th>Key Supporting Analyses</th>
<th>Potential APF Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Amount of revisions required to current proposal language before LATF exposure

Field tested APFs

"Field tested" APFs

Interpretation survey and representative analyses

Representative analyses

Interpretation survey and representative analyses

Interpretation survey results and additional analysis

Field test solutions

Proposed solutions

Reinsurance agreements unique contract provisions, relationships, and risks associated with the underlying

Prescribed solutions provide more uniformity but may not fully account for the

Judgement allowed by the potential solution

Prescribed solutions provide a single level of risk shifting between all ceding companies and reinsurers, may not account for the unique contract provisions, relationships, and risks associated with the underlying reinsurance agreements and assume a specific risk transfer, (e.g., prescribed reserve/credit, mortality improvement, "loss ratio trigger," etc.).
## Field Test Solutions

Comparison of potential long-term solutions based on results of the field test and interpretation survey

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of prescription sharing</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Variation in results</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
<td>More</td>
<td>Less</td>
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</table>
Supporting reports and presentations

APPENDIX A
### Detailed Test Results

Compiled and documented by the American Academy of Actuaries

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<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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<th>Date</th>
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</table>

**Academy Reports**

Detailed reports published by the Academy are posted to the NAIC website with this report.
Prior presentations are posted to the NAIC website along with Academy reports and this report.

Initial presentation focused on education of modeling reinsurance under PBR, initial representative PBR model design and analysis of the APFs.
Prior presentations are posted to the NAIC website along with Academy reports and this report.

Supplement focused on reviewing drivers of differences due to PBR which cause asymmetries between a direct company’s reserve credit and an reinsurer’s assumed reserve.

Supplement was focused on reviewing drivers of differences due to PBR which cause asymmetries between a direct company’s reserve credit and an reinsurer’s assumed reserve.

Concurrent Example (1 of 2)

Concurrent Example (2 of 2)
APPENDIX B

Model design and assumptions
<table>
<thead>
<tr>
<th><strong>Mortality</strong></th>
<th><strong>Lapse</strong></th>
<th><strong>Expenses</strong></th>
<th><strong>Liability Assumptions (ULSG)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Future mortality improvement of 0.50%</td>
<td>3% annual lapse rate</td>
<td>2% premium tax</td>
<td></td>
</tr>
<tr>
<td>A/E factors vary by high/low band</td>
<td>2% annual lapse rate</td>
<td>2.5% premium tax</td>
<td></td>
</tr>
<tr>
<td>Relative risk varies by risk class</td>
<td>0% lapse rate when the secondary guarantee is in-the-money (i.e. CSV &lt; 0)</td>
<td>2% inflation</td>
<td></td>
</tr>
<tr>
<td>Industry table: 2015 VBT with prescribed margins and mortality improvement scale</td>
<td>Prescribed margins applied to company mortality</td>
<td>$100 per policy (annual)</td>
<td></td>
</tr>
<tr>
<td>Fluctuation method credibility</td>
<td>Lapse</td>
<td>Expenses</td>
<td></td>
</tr>
<tr>
<td>Grading and margins assumes 100% limited</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>mortality improvement scale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The assumptions used in the analysis are below, including assumed PBR margins and margins.

- 2.5% inflation
- 105% margin on expenses
- Presumed margins applied to company mortality
- 2% inflation
- 2% premium tax
- $100 per policy (annual)
<table>
<thead>
<tr>
<th>Assumption</th>
<th>Anticipated experience assumption (e.g. margin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>Future mortality improvement of 50%</td>
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<tr>
<td></td>
<td>A/E factors vary by high/low band</td>
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<tr>
<td></td>
<td>Relative risk varies by risk class</td>
</tr>
<tr>
<td></td>
<td>2015 VBT gender distinct, smoker distinct AND</td>
</tr>
<tr>
<td>Lapse</td>
<td>100% stock lapse after level term period</td>
</tr>
<tr>
<td></td>
<td>6.5% during level term period</td>
</tr>
<tr>
<td>Expenses</td>
<td>2% premium tax</td>
</tr>
<tr>
<td></td>
<td>2.5% premium tax</td>
</tr>
<tr>
<td></td>
<td>$1000 face</td>
</tr>
<tr>
<td></td>
<td>Additional yr 1 expense $200 per policy and $0.40 per</td>
</tr>
<tr>
<td></td>
<td>$85 per policy (annual)</td>
</tr>
<tr>
<td>Margin</td>
<td>105% margin on expenses</td>
</tr>
<tr>
<td></td>
<td>2.5% inflation</td>
</tr>
<tr>
<td></td>
<td>95% margin on lapses</td>
</tr>
<tr>
<td></td>
<td>6.5% during level term period</td>
</tr>
<tr>
<td></td>
<td>10% stock lapse after level term period</td>
</tr>
</tbody>
</table>

The assumptions used in the analysis are below, including assumed PBR margins.
APPENDIX C

Supplemental results
FIELD TEST RESULTS AND ANALYSIS

APPENDIX C.1
"Baseline YRT scale with high credibility"

Coverage range (Representative PBR model)

75th percentile (Field test)

25th percentile (Field test)

Field Test Results Legend

Similar to ULSG, the Representative PBR model explains the variance in impacts of reinsurance on modeled reserves observed in field test submissions.

```
<table>
<thead>
<tr>
<th>BASELINE</th>
<th>TERM RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar to ULSG, the Representative PBR model explains the variance in impacts of reinsurance on modeled reserves observed in field test submissions.</td>
<td></td>
</tr>
</tbody>
</table>
```
Application of prudent estimate margins in Action B lowers the impact to DR and including additional parameters to determine the application of margins (Action C and Action D) reduces the variation in field test results.
Similar to UL56, introducing future mortality improvement to the projected claims reduces reinsurance gains. Given the current scale of reinsurance premiums is held constant...
Similar to ULSG, increasing the level of future mortality improvement has a similar impact on both APF 2019-41 and APF 2019-42.
**BASELINE | ULSG RESULTS**

**Development of unitized impact to DR for baseline YRT Rate scale and high credibility**

**Notes**

- Impact to DR is unitized as per 1000 of Ceded NAAR

\[
\text{Unitized Impact to DR for no change to YRT Rates} = \frac{(a) - (b)}{(c)} \times 1000
\]

<table>
<thead>
<tr>
<th>Pre-reinsurance (a)</th>
<th>13.78</th>
<th>23.68</th>
<th>4.03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-reinsurance (b)</td>
<td>1.425</td>
<td>3.462</td>
<td>4.426</td>
</tr>
<tr>
<td>Ceded NAAR (c)</td>
<td>11.961</td>
<td>5.901</td>
<td>5.155</td>
</tr>
<tr>
<td>Unitized Impact to DR (d)</td>
<td>3.821</td>
<td>5.446</td>
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<tr>
<td></td>
<td>2.847</td>
<td>5.350</td>
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</table>

C.13 - No change to YRT rates
**Notes**

- Unitized impact to DR is unitized as per 1000 of Ceded NAAR.
- Unitized impact to DR = \[ \frac{(a) - (b)}{(c)} \times 1000 \]

### Field Test Results and Analysis

**C.17 – Action D**

<table>
<thead>
<tr>
<th>Unitized Impact to DR (d)</th>
<th>9.49</th>
<th>13.11</th>
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<th>22.40</th>
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<tbody>
<tr>
<td>Ceded NAAR (c)</td>
<td>5.155</td>
<td>5.359</td>
<td>5.146</td>
<td>5.493</td>
<td>5.921</td>
</tr>
<tr>
<td>Post-Reinsurance DR (b)</td>
<td>2.062</td>
<td>2.190</td>
<td>2.509</td>
<td>2.714</td>
<td>3.386</td>
</tr>
<tr>
<td>Pre-Reinsurance DR (a)</td>
<td>2.416</td>
<td>2.116</td>
<td>4.180</td>
<td>5.629</td>
<td>6.426</td>
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<tr>
<td>Unitized impact to DR (d)</td>
<td>-4.54</td>
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**C.15 – Action B**

<table>
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<th>Unitized Impact to DR (d)</th>
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<th>4.031</th>
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<tr>
<td>Ceded NAAR (c)</td>
<td>5.155</td>
<td>5.359</td>
<td>5.146</td>
<td>5.493</td>
<td>5.921</td>
</tr>
<tr>
<td>Post-Reinsurance DR (b)</td>
<td>2.062</td>
<td>2.190</td>
<td>2.509</td>
<td>2.714</td>
<td>3.386</td>
</tr>
<tr>
<td>Pre-Reinsurance DR (a)</td>
<td>2.416</td>
<td>2.116</td>
<td>4.180</td>
<td>5.629</td>
<td>6.426</td>
</tr>
<tr>
<td>Unitized impact to DR (d)</td>
<td>-6.68</td>
<td>-7.94</td>
<td>-9.96</td>
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<td>-17.73</td>
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**C.14 – Action A**

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<tr>
<td>Post-Reinsurance DR (b)</td>
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<td>2.190</td>
<td>2.509</td>
<td>2.714</td>
<td>3.386</td>
</tr>
<tr>
<td>Pre-Reinsurance DR (a)</td>
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<td>2.116</td>
<td>4.180</td>
<td>5.629</td>
<td>6.426</td>
</tr>
<tr>
<td>Unitized impact to DR (d)</td>
<td>-2.49</td>
<td>-7.94</td>
<td>-5.65</td>
<td>-3.75</td>
<td>4.43</td>
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</table>

**Development of unitized impact to DR for baseline YRT rate scale and high credibility**

**APF 2019-40 | ULSG RESULTS**
Development of unitized impact to DR for baseline YRT Rate scale and high credibility

Notes

- Impact to DR is unitized as per 1000 of Ceded NAAR
- (a) is adjusted to be consistent with each post-reinsurance run
- (c) reflects the outer-loop ceded NAAR used in each scenario which is adjusted to as modeling technique for reinsurance margins
- Unitized impact to DR = [(a) - (b)] / (c) * 1000

Field test results and analysis

APF 2019-41 | ULSG RESULTS
Development of unitized impact to DR for baseline YRT rate scale and high credibility

Impact to DR is unitized as per 1000 of ceded NAAR

Unitized impact to DR = \[(a) - (b)\] / (c) * 1000

Notes:

• (c) reflects the outer-loop ceded NAAR used in each scenario which is adjusted to as a modeling technique for reinsurance margins

• (a) is adjusted to be consistent with each post reinsurance run

• Impact to DR is unitized per 1000 of ceded NAAR

• Unitized impact to DR = (a) - (b) / (c) * 1000

Field test results and analysis
## Notes

- Impact to DR is unitized as per 1000 of Ceded NAAR.

Unitized impact to DR = \( \frac{(a) - (b)}{(c)} \times 1000 \)

<table>
<thead>
<tr>
<th>Pre-reinsurance DR (a)</th>
<th>Post-reinsurance DR (b)</th>
<th>Ceded NAAR (c)</th>
<th>Unitized Impact to DR (d)</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>37,500</td>
<td>0.79</td>
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<tr>
<td>1</td>
<td>1</td>
<td>35,042</td>
<td>0.83</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>30,571</td>
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<td>5</td>
<td>5</td>
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C25 – No change in rates

Development of unitized impact to DR for baseline YRT Rate scale and high credibility.
## Development of unitized impact to DR for baseline YRT Rate scale and high credibility

### Notes

- Impact to DR is unitized as per 1000 of Ceded NAAR
- Impact to DR is unitized as per 1000 of Ceded NAAR

### Pre-reinsurance DR (a)

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<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-reinsurance DR</td>
<td>-9</td>
<td>102</td>
<td>254</td>
<td>336</td>
<td>327</td>
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</table>

### Post-reinsurance DR (b)

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<th>3</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-reinsurance DR</td>
<td>3</td>
<td>117</td>
<td>237</td>
<td>335</td>
<td>348</td>
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### Ceded NAAR (c)

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<tr>
<td>Ceded NAAR</td>
<td>37,500</td>
<td>35,042</td>
<td>30,572</td>
<td>26,644</td>
<td>9,406</td>
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### Unitized impact to DR (d)

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<tr>
<td>Unitized impact to DR</td>
<td>-0.32</td>
<td>-0.41</td>
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### APF 2019-40 | TERM RESULTS

Field test results and analysis
Development of unitized impact to DR for baseline YRT rate scale and high credibility

Notes

- Impact to DR is unitized as per 1000 of Ceded NAAR
- (a) is adjusted to be consistent with each post-reinsurance run
- (c) reflects the outer-loop ceded NAAR used in each scenario which is adjusted to fit a modeling technique for reinsurance margins
- Unitized impact to DR = [(a) – (b)] / (c) * 1000

Field test results and analysis
### Development of unitized impact to DR for baseline YRT Rate scale and high credibility

#### Notes

- Impact to DR is unitized as per 1000 of Ceded NAAR
- Unitized impact to DR = \((a) - (b)\) / (c) * 1000

#### Field test results and analysis

<table>
<thead>
<tr>
<th>Pre-reinsurance DR (a)</th>
<th>Post-reinsurance DR (b)</th>
<th>Ceded NAAR (c)</th>
<th>Unitized impact to DR (d)</th>
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<tbody>
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<td></td>
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<tr>
<td>C.33 – 5-years FMI</td>
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<tr>
<td>3.031</td>
<td>3.034</td>
<td>30.572</td>
<td>-0.045</td>
</tr>
<tr>
<td>3.034</td>
<td>3.036</td>
<td>30.572</td>
<td>-0.045</td>
</tr>
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<td>3.031</td>
<td>3.034</td>
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<td>-0.045</td>
</tr>
<tr>
<td>3.031</td>
<td>3.034</td>
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<td>-0.045</td>
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Field test results and analysis...
### Impact to DR for Illustrated Interpretation Scenarios

<table>
<thead>
<tr>
<th>Impact to DR (c)</th>
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<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-reinsurance DR (a)</td>
<td>1,978</td>
<td>5,652</td>
<td>6,322</td>
<td>4,903</td>
<td>3,183</td>
<td>1,627</td>
<td>640</td>
</tr>
<tr>
<td>Post-reinsurance DR (b)</td>
<td>1,425</td>
<td>5,001</td>
<td>5,576</td>
<td>4,206</td>
<td>2,685</td>
<td>1,411</td>
<td>541</td>
</tr>
<tr>
<td>Impact to DR (c)</td>
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<td><strong>651</strong></td>
<td><strong>746</strong></td>
<td><strong>696</strong></td>
<td><strong>696</strong></td>
<td><strong>696</strong></td>
<td><strong>696</strong></td>
</tr>
</tbody>
</table>

---

**C.39** – Break even after 1 year

---

**Notes**

- Impact to DR is (a) – (b)
- Impact to DR is (d) – (e)
- Impact to DR is (g) – (h)
- Impact to DR is (i) – (j)

---

**Development of Net DR for Illustrated Interpretation Scenarios**

Interpretation survey results and additional analysis.

### APF 2019-40 | ULSG Results

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**C.38** – Fully reactive after 1 year

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**C.37** – No change in rates
### Interpretation Survey Results and Additional Analysis

#### Notes
- Impact to DR is (a) – (b)
- Pre-reinsurance DR (a)
- Post-reinsurance DR (b)
- Impact to DR (c)

<table>
<thead>
<tr>
<th>Year</th>
<th>Impact to DR (c)</th>
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</thead>
<tbody>
<tr>
<td>17</td>
<td>-16</td>
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<tr>
<td>16</td>
<td>-9</td>
</tr>
<tr>
<td>15</td>
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<tr>
<td>14</td>
<td>3</td>
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<tr>
<td>13</td>
<td>4</td>
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<tr>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
</tbody>
</table>

- **C.40** – No change in rates
- **C.41** – Fully reactive after 1 year
- **C.42** – Break even after 1 year
### Development of Net DR for Illustrated Interpretation Scenarios

#### Notes

1. Impact to Net DR is (a) – (b).

#### Impact to Net DR (c)

<table>
<thead>
<tr>
<th>Pre-reinsurance DR (a)</th>
<th>Post-reinsurance DR (b)</th>
<th>Impact to DR (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,852</td>
<td>1,440</td>
<td>132</td>
</tr>
<tr>
<td>500</td>
<td>494</td>
<td>147</td>
</tr>
<tr>
<td>1,390</td>
<td>1,438</td>
<td>4</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>0</td>
</tr>
<tr>
<td>1,524</td>
<td>1,440</td>
<td>81</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
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</tbody>
</table>

C.43 – No change in rates
C.44 – Break even after 1 year

---

#### Development of Net DR for Illustrated Interpretation Scenarios

Interpretation survey results and additional analysis

APF 2019-41 | ULSG RESULTS
<table>
<thead>
<tr>
<th>Impact to DR (c)</th>
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<th>15</th>
<th>13</th>
<th>11</th>
<th>9</th>
<th>7</th>
<th>5</th>
<th>3</th>
<th>1</th>
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<tbody>
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<td>Pre-reinsurance DR (b)</td>
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<td>353</td>
<td>355</td>
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</tr>
<tr>
<td>Post-reinsurance DR (a)</td>
<td>-39</td>
<td>170</td>
<td>264</td>
<td>327</td>
<td>343</td>
<td>324</td>
<td>222</td>
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<td>3</td>
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</table>

Notes:
- C46 – Break even in 1 year
- C45 – No change in rates

Development of Net DR for Illustrated Interpretation Scenarios

APF 2019-41 | TERM RESULTS

Interpretation survey results and additional analysis.
### Notes

- Impact to DR is (a) – (b)

**Impact to DR (c)**

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<tr>
<th></th>
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<th>20</th>
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<th>50</th>
<th>60</th>
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<tbody>
<tr>
<td>Pre-reinsurance DR (a)</td>
<td>1,978</td>
<td>5,652</td>
<td>6,322</td>
<td>4,903</td>
<td>3,183</td>
<td>1,627</td>
<td>640</td>
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<tr>
<td>Post-reinsurance DR (b)</td>
<td>2,102</td>
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<td>-140</td>
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<td>-67</td>
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**Development of Net DR for Illustrated Interpretation Scenarios**

**C.47** – Fully Reactive after 1 year

**C.48** – Fully Reactive after 1 year, including 10 year MI

**C.49** – Break Even after 1 year

---

**Development of Net DR for Illustrated Interpretation Scenarios**

**Impact to DR (c)**

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<th></th>
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<td>6,107</td>
<td>4,723</td>
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<td>1,564</td>
<td>594</td>
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<td>Impact to DR (c)</td>
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<td>151</td>
<td>225</td>
<td>151</td>
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**Development of Net DR for Illustrated Interpretation Scenarios**

**Impact to DR (c)**

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<td>Year</td>
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<tr>
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### Notes
- **C.50** – Fully reactive after 1 year, including 10 year MI
- **C.51** – Fully reactive after 1 year, including 10 year MI
- **C.52** – Break even after 1 year

Development of Net DR for illustrated interpretation scenarios
- APF 2019-42 | TERM RESULTS
- Interpretation survey results and additional analysis
The consultant analysis will be overseen by NAIC Staff, the Academy, and the ACLI, as depicted in the following chart.
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