The following is a discussion on the use of a substitute mortality table, prepared by the American Academy of Actuaries'[1] Pension Committee.

Substitute Mortality
Credibility

Applicable Law

Pension Protection Act (PPA) Sec. 102(a) adding new ERISA Sec. 303(h)(3)(C)(iii)
PPA Sec. 112(a) adding new Internal Revenue Code (IRC) Sec. 430(h)(3)(C)(iii)

Description of Issue

In order to use a substitute mortality table, subsection (h)(3)(C)(iii) requires that a plan have "a sufficient number of plan participants, and the pension plans have been maintained for a sufficient period of time, to have credible information necessary for purposes of" reflecting "the actual experience of the pension plans maintained by the sponsor …".

Proposal

We propose that regulatory guidance – without ruling out other approaches – permit the following methods and variations.

Method I: Credibility Theory is a formal statistical theory developed by actuaries over the past century. While there are a variety of complex approaches, all ultimately produce a formula of the form: Z x plan's mortality + $(1 - Z)$ x standard mortality, where the larger the plan and its number of deaths, the greater the value of Z (even if the plan's mortality experience isn't significantly different than standard mortality). Under this theory or approach, *all* plans would have enough experience to *partially use* a substitute mortality table and some plans would have enough experience to *fully use* a substitute mortality table.

Thus, the above formula is used no matter how small the plan. A small plan would just have a small Z, and thus the substitute table would be quite close to the standard table. It is felt that, even in a small plan, the modified table would be better than if the standard table were used. If desired, there could be a cutoff for this method based on number of deaths, or size of Z – e.g., this method should not be used if Z

[1] The American Academy of Actuaries is a national organization formed in 1965 to bring together, in a single entity, actuaries of all specializations within the United States. A major purpose of the Academy is to act as a public information organization for the profession. Academy committees, task forces and work groups regularly prepare testimony and provide information to Congress and senior federal policy-makers, comment on proposed federal and state regulations, and work closely with the National Association of Insurance Commissioners and state officials on issues related to insurance, pensions and other forms of risk financing. The Academy establishes qualification standards for the actuarial profession in the United States and supports two independent boards. The Actuarial Standards Board promulgates standards of practice for the profession, and the Actuarial Board for Counseling and Discipline helps to ensure high standards of professional conduct are met. The Academy also supports the Joint Committee for the Code of Professional Conduct, which develops standards of conduct for the U.S. actuarial profession.

is less than 0.25 or there are fewer than 100 deaths. A detailed discussion of this theory (with an example) is provided in the appendix.

Method II (Determining if there is a significant difference): Method II is an alternative approach which insurance actuaries inform us has also been used.[2]

A plan's actual number of deaths would be compared with the expected number of deaths using the standard mortality table projected to the calendar years being studied (or the central calendar year).

Classic statistical methods for assessing if something is significantly different from a standard start with a *null hypothesis* that they are the same, and an assessment whether that hypothesis can be disproved (with a minimal chance of error). In our case, we would set a null hypothesis that the mortality of the plan matches that of the standard mortality table, and test that hypothesis by comparing the actual number of deaths with the expected number of deaths. We would then use 'X' standard deviations to ascertain whether the difference is due merely to random fluctuation or due to the plan's mortality really being worse (or better) than the standard mortality table (i.e., we would decide to treat mortality differences as statistically significant if the ratio of actual to expected deaths exceeds (or is less than) 1 by more than a certain number of standard deviations). For example, if we used 1.645 standard deviations, for situations in which the plan's "true" mortality matches standard mortality, we *would incorrectly* say that the plan's mortality experience is different from the standard mortality table only 5 percent of the time. (The 5 percent assumes that it made sense that the plan's mortality would be greater than (or less than) the standard table, but not both.[3]) If 1.96 standard deviations were used, we would be wrong only 2.5 percent of the time. An example is provided below.

Regulatory guidance would not need to require a minimum number of years of experience since Method II requires a certain amount of data to prove that the experience is significantly different from the standard table. For example, five years experience might be needed to get enough experience to satisfy this test for a smaller plan. For a very large plan, one year would be sufficient. (If regulatory guidance should require a specific minimum number of years, then we suggest that exceptions be allowed for certain plans of the sponsor — e.g., plans acquired recently and plans where the sponsor certifies that the data are not available.)

Method II Application: Without ruling out other approaches, regulatory guidance would permit a mortality table to be developed in one of the following ways, once it was determined that the actual deaths are significantly different from the expected:

(1) By multiplying the standard mortality rates by the ratio of actual to expected deaths (and grading into q_x equal to 100 percent at age omega);
(2) By using the standard table with an age set back (or age set forward) so that the expected deaths are closer to the actual number of deaths. Fine-tuning could be achieved by multiplying it by the ratio of actual deaths to expected deaths under the set back (or set forward) table;
(3) By modifying the RP2000 blue-collar table (for appropriate blue-collar groups — i.e., not airline pilots or nurses) or the RP2000 white-collar table (for white-collar groups) by multiplying it by

[2] The use of Method I and Method II was confirmed by consultant Harvey Sobel, Principal and Consulting Actuary with Buck Consultants in Secaucus, NJ.

[3] If it was not obvious up front that the mortality would be worse (or better, in the case of say a white collar plan), then the two-sided test is used, which would mean we would be incorrect 10 percent of the time.

the ratio of actual to expected (determined using the appropriate collar table), as suggested in (1) above; or

(4) By creating a table directly from the experience q_xs at each quinquennial age (with graduation allowed, such that expected deaths equal actual deaths). This method might be used only with large plans in the controlled group, where one might consider requiring statistical testing at each quinquennial age grouping where this method is used (and one age grouping at the oldest and youngest ages where the data is sparse).

This mortality table would then be projected just as the standard table is projected.

Piecewise Determination: Large plans might have enough data to determine the ratios for different age groupings, for males and females separately, or for the annuitant and non-annuitant tables separately. In addition, we note that the RP2000 experience by collar became quite similar for people over age 80 (whether they had blue or white collar jobs, etc.[4]). Thus, the regulation could allow sponsors to analyze their experience just below age x (e.g., age 80), and then only apply the factor to ages below age x, and phase the modified table into the standard table from age x up to age x + 5, or x + 10.

Standard Deviation: In order to use this method, the standard deviation would need to be determined. The distribution of deaths is the sum of many binomial distributions, so the mean is the actual number of deaths ($n \times q_x$), the variance is $n \times p_x \times q_x$, and the standard deviation is the square root of the variance.[5] Unless the number of deaths is very small (somewhat below 20), the central limit theorem tells us that the distribution can be approximated very well by the normal distribution.

Example: Assume that a sample population of 5,000 people has 100 expected deaths using the standard mortality table. Assume, as discussed in the prior section, that the variance is also 100, so the standard deviation is 10 deaths. Also assume that the actuary uses two standard deviations to test the null hypothesis. The actual deaths would have to be greater than 119.6 (100 + 10 x 1.96) or 20 percent different, in order to recognize that the plan's mortality was significantly different than the standard table's mortality.

If the sample population were larger by a factor of 100 (i.e., 500,000 people), the example would be as follows: Expected deaths would be 10,000 and the standard deviation would be 100 deaths. Actual deaths would have to be greater than 10,196 (10,000 + 100 x 1.96) or 2 percent different, in order to recognize that the plan's mortality was significantly different than the standard table's mortality.

Thus, a medium sized plan would have to have a much greater difference in mortality rates in order to use its own experience. A large plan would not need as much difference in order to use its own experience.

Administration: If detailed review of every plan requesting a substitute mortality table would overburden IRS, the regulation could provide for IRS approval if the plan actuary's mortality study follows a procedure explicitly permitted by the regulation, subject to Internal Revenue Service (IRS) audit, and if the plan actuary certifies that he or she followed IRS procedures and certifies that the

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[4] See top paragraph on 6th page of Chapter 5 of the SOA's RPA2000 report (www.soa.org/ccm/cms-service/stream/asset/?asset_id=9700104) and the accompanying charts Figure 5-1 and Figure 5-5.

[5] Note: the variance is quite close to the mean since p_x is very close to 1 (except at the oldest ages, which might be excluded anyway), so some practitioners may use the mean for the variance.

substitute mortality table is their best estimate of plan mortality. This certification could be on an attachment to the Schedule B.

Amounts Weighted: Under approaches that are explicitly permitted by regulatory guidance, the experience might reflect amounts-weighting for purposes of determining the substitute table. Since higher-income people live longer on average, this could reduce the q_xs in the substitute table. Where data difficulties or other considerations are present, a sponsor could request IRS approval of a substitute table based on by-lives experience, with adjustments if appropriate, to approximate an amounts-based result.

Substitute Mortality
When there are Small and New Plans in Controlled Group

Applicable Law

PPA Sec. 102(a) adding new ERISA Sec. 303(h)(3)(C)(iv)
PPA Sec. 112(a) adding new IRC Sec. 430(h)(3)(C)(iv)

Description of Issue

Sec. (C)(iv) states that *all* plans must use their own separate table, so that anti-selection is avoided. Blue-collar plans should not be able to use a substitute table (producing lower costs) while the white-collar plan uses the standard table (producing lower costs than if their own substitute table was used). In order to implement this, the requirements of Sec. (C)(iii) must be met for each plan in the controlled group, *taking into account only the participants in such plan.* This would preclude many large plans that have sufficient data and sufficiently non-standard experience from using a substitute table, simply because one or more other plans in the controlled group are too small or too new to have credible data under Sec. (C)(iii)(I),[6] which couldn't be the intent of this rule. A solution is possible since the Secretary of Treasury is given authority to provide for exceptions to this rule in the first sentence of Sec. (C)(iv).

Proposed Exceptions

1. **Exclude "Small Plans" and "New Plans" from "Each Plan" Test:** If a controlled group with a plan that is large enough to use Method I or Method II, also has a plan or plans without enough data or time to use the same method, then the regulation would specify that the "each plan" test ignore such "small plans" and "new plans."[7]
2. **Small Plan Table:** Small plans could be required to use the standard table. Plans that are not small would have to use their substitute table. Alternatively, the regulation could permit an approach under which all plans use the modified table that the method in use for the large plan would produce for each plan.
3. **Abuse:** The Secretary would have authority to not allow the use of these rules where the facts and circumstances indicate that a plan in the controlled group has been changed (e.g., split in half so that it is now a "small" plan) for the purpose of being deemed not to have credible mortality experience under this rule.
4. **Corporate Mergers and Acquisitions:** In the case of a corporate merger or acquisition, any plans acquired into the controlled group as a result of the transaction should be ignored for purposes of the "Each Plan" test, until the second or third plan year after the transaction occurred. That is, if the transaction is completed in plan year x, then any new plans acquired into

[6] Sec. (C)(iii)(I) states: ''there is a sufficient number of plan participants, and the pension plans have been maintained for a sufficient period of time, to have credible information necessary for purposes of subclause (II)"

[7] We thought it important to have the *same* rule for determining whether a plan was small as the rule used to determine whether a plan was large enough to satisfy *(C)(iii)(I)*. There are problems with using a simpler rule, such as 100 deaths. While simpler for plan sponsors to apply, it would create confusion for plans that were large enough to satisfy (C)(iii)(I) and thus use a substitute table under the primary rule suggested on page 1, but also small enough to satisfy the small plan rule. It would also create problems for plans that were too small to satisfy the primary rule on page 1 but big enough to not qualify for the small plan rule.

the controlled group would be ignored in applying this rule, until plan year x+3. This will allow time to collect the experience data necessary for the "Each Plan" test, and for it to have enough experience to be credible. Until then, the plan could use the same table it had used in prior years (which could be the standard table or a substitute table).

5. **Plan Mergers and Spin-offs:** Under Sec. (3)(C)(ii) a substitute table ceases to be in effect after a merger or spin-off. That should not affect the use of substitute tables used for other plans in the controlled group. Otherwise this provision could either keep large controlled groups from implementing mergers/spin-offs, or it would nullify the use of this provision, which Congress could not have intended. The IRS could allow the continued use of substitute tables if, for example, the merged plan used a proportional blending of the two prior tables. If one of the plans was de minimis (i.e., less than 3 percent of the size of the other plan), then the mortality table of the larger plan could be allowed. Parallel permissions could be created for spin-offs.
6. **Use for 10 years:** PPA allows the use of the substitute table for 10 years. However, as noted in Sec. (3)(C)(ii), it could become inappropriate, due to changes in plan demographics (for example, due to many new hires and quits, etc.). IRS guidance could allow the plan actuary to revise the substitute table if provided a signed statement by the plan actuary stating that the new table is more appropriate than the original table, using the same methods as used in the original submission. For example, if Method I is used and Z changes more than a certain amount, the actuary would use the newer Z. If Method II is used, and the ratio of actual to expected changes enough so that it is significantly different than the substitute table, the actuary would use a revised table based on the new experience.

Discussion

The purpose of the statutory rule appears to be to require each plan to use its own appropriate table to prevent "anti-selection" in applying the substitute mortality table rules. In other words, it would not be desirable for a plan sponsor to use a substitute table for a large plan that is known to have higher mortality than the standard table, but not for another plan that has lower mortality.

Most organizations with a plan large enough to apply a substitute mortality table are likely to also have "small plans," as defined above. This would preclude the new Sec. 430(h)(3)(C) from having any effect, so it must not have been Congress' intent. It would not seem reasonable to forbid the use of a more accurate substitute table for such large plans.

Generational Mortality
Regulation Issue

Applicable Law

New ERISA Sec. 303(h)(3)(A)
New IRC Sec. 430(h)(3)(A)
IRS's December 2005 mortality table proposed regulation

Description of Issue

The second sentence of Sec. 430(h)(3)(A) requires the valuation mortality table to be "based on the actual experience of pension plans *and projected trends in such experience*."

The proposed mortality regulation for current liability for 2007 requires annuitant mortality rates to be projected to the valuation date plus seven years and non-annuitant mortality rates to be projected to the valuation date plus 15 years.

Proposal

We propose that sponsors have the option to use a generational table — for example, RP2000 with Scale AA applied on a generational basis — whether the plan uses the standard table or a substitute table.

Since the proposed regulation has not been finalized yet, and this is a new idea, there may not be enough lead-time for some actuarial firms to revise their valuation programs in time for the 2007 valuation. If IRS would delay the effective date of the proposed regulation to 2008 plan years, then employers will not need to change their mortality table in 2007 to the non-generational version and then change again in 2008 to the generational version.

Note: If it is determined that the stronger RP2000 table is needed for 2007, temporary relief could be provided for 2007 by allowing the *aggregate* RP2000 table (without the breakdown by annuitants and non-annuitants, but with projection to a fixed date), so that substantial changes wouldn't have to be made to valuation programs in the now very short time period before year end.

There is another concern with the proposed regulation. The software at some actuarial firms switches from the non-annuitant table to the annuitant table at exit date (not benefits commencement date as in the proposed regulation). Since this minor difference would not make much difference in the results and is theoretically justified, we suggest that the proposed regulation allow both methods (at the very least for the 2007 valuation).

Discussion

Not only is the use of generational mortality tables desirable, but it also means that the mortality table does not have to be changed each year (as under the proposed regulation). In addition, virtually any

actuarial software program can apply generational tables, making accurate projections of liability and normal cost much easier.

If desired, the regulation could stipulate that a sponsor could not move back to the simplified (non-generational) version of the mortality table unless approved by the IRS.

Appendix: Credibility Theory[8]

There are two types of traditional credibility: greatest accuracy and limited fluctuation. Only the latter one will be discussed here. The key result of limited fluctuation credibility is that when a certain sample size is achieved the data can stand on its own (full credibility). The criterion for full credibility is that there is enough data so that the estimate of the mortality ratio (actual to expected deaths) will be within 100*h* percent of the true value Y percent of the time. The idea is that if there is enough data, it can be trusted because the answer can be relied upon. The required sample size is achieved if the standard deviation of the mortality ratio is less than *h*/*z* where *z* is the appropriate percentile from the standard normal distribution (for example, for 90 percent confidence, set *z* equal to 1.645).

The variance of the mortality ratio can be estimated as $\sigma_r^2 = \frac{\sum n_x q_x^* (1-q_x^*)}{e^2}$ where the *q*'s can be from the data or from the standard table, the *n*'s are the sample sizes at each age and *e* is the expected number of deaths. As a crude approximation, assume that the *q*'s are nearly zero. Then the numerator is close to *e* and so the variance is 1/*e* (the actual number of deaths could also be used). So there is full credibility if $1/e < h^2/z^2$. As an example, suppose we required that the observed ratio be within 20 percent of the true ratio 95 percent of the time. Then the number of deaths must exceed $1.96^2/0.2^2 = 96$. Note that except for rounding this matches the example presented earlier where 100 deaths implied a 20 percent deviation is needed to be declared credible.

Should the observed number of deaths be less than the standard calculated, then the credibility formula uses *Z* = sqrt(observed deaths/required deaths). In the example from the previous paragraph, suppose there were 48 observed deaths. Then *Z* = sqrt(48/96) = 0.71 and the resulting table would be 71 percent of the experience plus 29 percent of the standard. Or, if the actual to expected ratio of deaths was, say, 1.2, then the table to use would be 0.71(1.2) + 0.29(1) = 1.142 times the mortality rates in the standard table.

Methods I and II are very different in application. In the example, with limited fluctuation credibility and using the given parameters (20 percent and 95 percent), any plan with 96 deaths would be entitled to stand alone as having credible mortality. This would be independent of the difference between the plan's experience and the standard table.

With the alternative method presented earlier, the ability to use plan experience depends on both the amount of data and the difference between experience and standard. There is nothing statistically more correct about one approach over the other. It depends on what form is desired for the solution.

[8] Stuart Klugman, Ph.D., FSA, and Professor of Actuarial Science Drake University provided this appendix.