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The Guaranteed Investment Defined Contribution Plan

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Abstract

Individuals enjoy the safety of principal and income accumulations afforded to bank-held savings accounts through FDIC coverage. Defined contribution (DC) plan participants and plan sponsors mutually enjoy the guaranteed returns from safe GIC investments when their rates are competitive. The proposed plan, the *guaranteed investment defined contribution* (GIDC) plan, offers similar safety for principal and income accumulations and guaranteed investment returns.

The GIDC plan is a floor-offset arrangement. The floor plan is a cash balance defined benefit (DB) pension plan. The offset plan is a money purchase DC plan with participant-directed investments. This paper examines GIDC plan issues, including its general design, regulatory and nondiscrimination compliance, current liability properties, PBGC premium requirements, interplay between long-term investment guarantees and actual investment choices, and miscellaneous considerations. In addition, specific design requirements are developed to provide the GIDC plan true DC plan operational appeal.

1. Introduction

The main premise of a GIDC plan is to provide a minimum investment guarantee to participants in a participant-directed money purchase plan. With that minimum investment guarantee, participant investors will be freed from the risk of principal loss, allowing them to invest more aggressively, hopefully in line with their investment

education. Precautions, including design constraints, may be needed to discourage speculation. We will illustrate the effect of participant investment styles on expected *money purchase offset plan* investment experience and on *cash balance floor plan* benefit levels.

The other premise of a GIDC floor-offset arrangement is to provide safety for all principal and income accumulations. This is achieved primarily through the cash funding directed to the ERISA trusts for the money purchase offset plan and cash balance floor plan. Funding shortfalls in the cash balance floor plan would presumably be protected by PBGC plan termination insurance. This paper assumes that outstanding questions about the precise application of PBGC benefit guarantees to cash balance plans will be resolved in due course.

The investment guarantee in a GIDC plan is provided by the cash balance floor plan's crediting interest rate. The GIDC plan provides a cumulative investment guarantee for a participant's money purchase offset plan contributions. In other words, a guaranteed (cash balance) minimum account balance based on actual money purchase plan contribution levels and the GIDC's guaranteed investment rate is a floor account balance value.

A large portion of this paper involves the challenge of applying the existing body of pension plan legal requirements primarily intended to regulate traditional DB plans to the design of a GIDC plan. Given the limited guidance for cash balance plans (let alone a floor-offset cash balance plan), where questions arise, a reasonable good-faith interpretation of applicable code provisions is required and may be offered in this paper.

With respect to valuation liabilities, this paper only analyzes the properties of current liability and uses that analysis when considering PBGC variable premium requirements. An analysis of ERISA funding and SFAS No. 87 expense considerations is outside the scope of this paper.

2. General Plan Design Description

The GIDC plan is a traditional floor-offset arrangement. The offset plan is a money purchase DC plan with participant-directed investments among an ERISA §404(c) compliant array of investment options. Participants active during the plan year are eligible for employer contributions according to contribution eligibility requirements. Employer contribution design can be any type that may be used in a money purchase

plan that is not part of a GIDC floor-offset arrangement, subject to the accommodation of the GIDC plan's compliance with regulatory and nondiscrimination requirements.

The floor plan is a cash balance DB plan. A participant receives contribution credits identical in amount and timing as those provided under the money purchase offset plan and interest credits at the stated rate. Participants accrue contribution credits until separation from service and interest credits until account distribution, at which time cash balance floor plan benefits are offset by money purchase offset plan benefits with any remaining net benefit payable from the cash balance floor plan.

In fact, because the money purchase offset plan and cash balance floor plan are both IRC § 412 plans, they actually could be components of the same plan. Regardless, they each must contain the same provisions for:

- Eligibility service, participation eligibility requirements, and plan entry dates.
- Benefit or contribution service, definitions of compensation and integration levels (if applicable), and contribution eligibility requirements.
- Vesting service, vesting schedule and eligibility requirements for disability; death; and early, normal, and late retirement.

In addition, the money purchase offset and cash balance floor plans each have a death benefit equal to 100% of benefits accrued. To preserve the appeal of the GIDC plan, the cash balance floor plan has a lump-sum payment option that provides no less than the cash balance floor plan account value. Furthermore, both the money purchase offset and cash balance floor plans are assumed to be noncontributory.

3. Illustrative Provisions and Account Balances Projection

Table 1 presents a set of illustrative provisions for a calendar year GIDC plan. Eligibility conditions for distribution upon or after early retirement, normal retirement, late retirement, disability, death, or vested termination are the same in both plans.

Table 2 will be used for the example GIDC account balances projection in Table 3. Columns A through C in Table 2 above are actual annual percentage calendar-year returns for 1-year Treasury bills with constant maturities, the S&P 500 stock composite, and the S&P long-term bond composite (of utilities, industrials and governments), respectively, for 1962 through 1996. Column A forms the basis for the investment guarantee under our illustrative GIDC plan provisions, which is determined in column D.

Columns B and C form the bases used to develop the illustrative investment experience under alternative participant investment styles. Column E is the illustrative investment experience for a conservative participant investment style of 15% in stocks and 85% in bonds. Column F is the illustrative investment experience for a balanced participant investment style of 60% in stocks and 40% in bonds, whereas column G is for an aggressive participant investment style of 85% in stocks and 15% in bonds.

Table 3 presents the projection of the distributable account balances under the money purchase offset plan and cash balance floor plan with respect to our illustrative GIDC plan provisions assuming the alternative participant investment styles described above. Salary increases are based on the percentage increases in the CPI-U index plus 1.0%. The money purchase offset plan's distributable account balance is projected using the participant's investment experience. The cash balance floor plan account balance is the guaranteed minimum account balance, which is calculated using the long-term guaranteed investment rate. The cash balance floor plan's distributable account balance in each year is the excess, if any, of the guaranteed minimum account balance over the money purchase offset plan's distributable account balance.

4. Regulatory Compliance other than Nondiscrimination Compliance

This section addresses the following regulatory compliance areas for a GIDC plan: nonforfeiture of accrued benefits, definitely determinable benefit requirements, benefit accrual (anti-backloading) requirements and statutory minimum lump-sum determinations. These areas are all visited to varying degrees in IRS Notice 96-8, which specifically addressed cash balance plans. That Notice represents the IRS's most recent published guidance for cash balance plans and presumably presents the foundations upon which future final regulations will be based. IRS Revenue Ruling 76-259 provides guidance for the floor-offset aspects associated with some of the issues to be addressed.

4.1 Accrued Benefit Nonforfeiture

In IRS Notice 96-8, the IRS argues that benefits attributable to interest credits in a cash balance plan are accrued benefits rather than ancillary benefits. Therefore, once contributions are credited, they and their future interest credits to normal retirement age are accrued. These “frontloaded interest credit plans” must provide for the accrued future interest credits on a definitely determinable basis. Also, accrued future interest credits may not understate the rate of interest index values in effect at the time of the associated contribution in order to avoid a prohibited accrued benefit forfeiture.

4.2 Definitely Determinable Benefits

IRS Revenue Ruling 76-259 provides guidance on floor-offset benefits being definitely determinable. Assuming the DB floor plan provides definitely determinable benefits before offset, the offset must be determined in a manner that precludes discretion on part of the employer. In particular, the DB plan must provide the actuarial basis used to determine the benefit deemed to be the offset provided by the DC offset plan and must specify the time as of which such determination is made (the determination date).

If the DB floor plan is a cash balance plan with a crediting interest rate based on a variable index, IRS Notice 96-8 requires the plan to prescribe the method for reflecting future interest credits in the calculation of a participant’s accrued benefit in a manner that precludes employer discretion in order to maintain definitely determinable benefits. One approach is to base future interest credits in the calculation of a participant’s accrued benefit on the last index value in effect as of the determination date.

In addition, the normal form of payment in a cash balance floor plan must be defined as an annuity directly or by reference. More specifically, a cash balance floor plan with more than one annuity option which defines its normal form of payment as a lump sum without reference to a stated annuity may not provide definitely determinable benefits. In this situation, different procedures for determining actuarial equivalence could produce different payment amounts for a desired annuity form.

For example, an account balance projected to NRA with credited interest could be converted directly to the desired annuity form or, alternatively, the projected account balance could be first converted to a different annuity form and then converted to the desired annuity form. Different payment amounts will result if the plan’s postretirement bases for lump-sum determinations and annuity conversions are different.

4.3 Benefit Accrual Requirements

IRS Revenue Ruling 76-259 also provides guidelines as to how the accrued benefits of a DB plan that are offset by the benefits of a DC plan should be tested to determine whether the accrued benefit requirements of IRC § 411(b) are satisfied for the DB plan, which in our case is the cash balance floor plan. IRS Revenue Ruling 76-259 provides that DB plan accrued benefits will be deemed to satisfy the requirements of IRC § 411(b) if the two following conditions are satisfied:

- Without regard to the offset, the accrued benefits of the DB plan satisfy IRC § 411(b).
- The offset to the DB plan benefit otherwise payable is equal to the amount deemed provided on the determination date by the vested portion of the account balance under the money purchase offset plan.

4.4 Statutory Minimum Lump Sums

IRS Notice 96-8 also made clear that a cash balance plan, being a DB plan, must still comply with statutory minimum lump-sum requirements. Therefore, no less than the statutory minimum lump-sum value may be distributed as a lump sum from a cash balance plan. To distribute the cash balance plan account balance at distribution after termination, the account balance must be at least as large as the statutory minimum lump-sum value.

Provided that certain conditions prevail, IRS Notice 96-8 allows for the choice from several safe harbor cash balance plan crediting interest rates (variable index rates plus a maximum associated margin), which come with deemed compliance with the statutory minimum lump-sum requirements if the cash balance account balance is distributed.

In Appendix A, the conditions necessary to assure payment of the cash balance plan account balance are explored, exposing the basis for the safe harbor cash balance plan crediting interest rates as well as a potential trap. However, we will discover that pursuing a “true DC plan operational appeal” for the GIDC plan will, by design, avoid this trap.

5. Nondiscrimination Compliance

5.1 Minimum Participation and Coverage

The cash balance floor plan must comply with minimum participation requirements of IRC § 401(a)(26). In addition, both the cash balance floor plan and the money purchase offset plan must comply with the minimum coverage requirements of IRC § 410(b). To that end, a few observations are offered:

- An employee is treated as benefiting under the cash balance floor plan in a plan year, even when there is no cash balance floor plan benefit accrual for the plan year, if the cash balance floor plan before offset and the offset satisfy reasonable conditions.¹
- Whenever the active participant population in the cash balance floor plan and money purchase offset plan are not the same, permissively aggregating the plans to test for coverage nondiscrimination may be employed.
- If average benefits testing is required, the nominal contribution credits of the cash balance floor plan may be treated as equivalent DC plan contributions provided the cash balance floor plan meets the requirements set forth under the cash balance safe harbor testing method.²

5.2 Cash Balance Safe Harbor Testing Method and Cross-Testing

Before investigating nondiscrimination in amounts compliance for a GIDC floor-offset arrangement, we first examine the requirements for a cash balance alone (i.e. before any offset) to satisfy benefits nondiscrimination under the cash balance safe harbor testing method or, alternatively, under the cross-testing rules.³

A cash balance plan will meet the requirements of the cash balance safe harbor testing method if it satisfies several “basic requirements” and one of two alternative “contribution credit requirements.” In general, the basic requirements are satisfied if the cash balance plan:

¹ See IRS Reg. §§ 1.401(a)(4)-5(a)(2) and 1.401(a)(4)-3(a)(2)(iii).

² See IRS Reg. § 1.401(a)(4)-8(c)(3).

³ See IRS Reg § 1.401(a)(4)-8(c)(2).

- Is a traditional hypothetical account design that is a frontloaded interest credit plan with definitely determinable benefits and is compliant with accrued benefit nonforfeiture and statutory minimum lump-sum requirements.
- Credits interest using either a fixed standard rate⁴ or a “permissible variable interest rate.”⁵
- Has a plan lump-sum basis that uses a standard mortality table and an interest assumption equal to either a standard rate or the plan’s crediting interest rate.
- Provides optional forms using uniform factors, which are unsubsidized unless the plan meets the DC uniform allocation safe harbor.⁶
- Is not contributory, provides contribution credits after normal retirement age and uses uniform vesting schedule and service requirements, generally not allowing for past service credits.

If a cash balance plan meets the above basic requirements, it will be considered to have satisfied benefits nondiscrimination on the basis of equivalent contributions (under cross-testing requirements) if it meets one of the two following alternative contribution credit requirements:

1. *Uniform Allocation Safe Harbor*: cash balance plan contribution credits, if considered contributions under a DC plan, would satisfy the DC uniform allocation safe harbor.
2. *Modified General Test*: cash balance contribution credits, if considered contributions under a DC plan that is not aggregated with any other DC plan, would satisfy the DC plan general test for nondiscrimination in contributions.⁷

If not eligible for the cash balance safe harbor testing method, a cash balance plan may satisfy benefits nondiscrimination on the basis of equivalent contributions under cross-testing requirements directly. In general, the cash balance plan must meet the DB plan general testing requirement for benefits nondiscrimination using equivalent normal retirement (and most valuable) allocation rates instead of the normal retirement (and most valuable) accrual rates from which they are converted under the cross-testing rules.

Under these rules, the increase in the cash balance (frontloaded interest credit) plan accrued benefit converted to the plan’s normal form under the plan’s lump-sum basis are

⁴ See IRS Reg § 1.401(a)(4)-12.

⁵ See IRS Reg § 1.401(a)(4)-8(c)(3)(iv)(C)(2) for the available selection, which is not identical to the list of safe harbor indices under IRS Notice 96-8.

⁶ See IRS Reg § 1.401(a)(4)-2(b)(2).

⁷ See IRS Reg § 1.401(a)(4)-2(c).

converted to equivalent allocation rates using a standard interest assumption and standard postretirement mortality assumption (no preretirement mortality).

5.3 Cash Balance Floor Plan Nondiscrimination Compliance for Amounts

Nondiscrimination in amounts for the money purchase offset plan involves the same design and testing considerations applicable to DC plans, in general, subject to the role it may play in the benefits nondiscrimination compliance of the GIDC plan. Nondiscrimination in amounts for the cash balance floor plan is the primary subject of this section.

5.3.1 Floor-Offset Safe Harbor

The cash balance floor plan, depending upon certain design elements, may qualify for a safe harbor exemption from benefits nondiscrimination testing for DB plans that are part of floor-offset arrangements. To qualify for the exemption, the following requirements must be met⁸:

- 1) A participant's offset to the vested cash balance floor plan benefit must be the actuarial equivalent of the vested portion of the participant's employer-provided money purchase offset plan account balance. The term actuarial equivalent for these purposes may not use an interest rate higher than the highest standard interest rate and no preretirement mortality. This requirement must apply to all employees covered under the cash balance floor plan on the same terms.
- 2) The cash balance floor plan may not be contributory. The money purchase offset plan must offer the same investment options and preretirement distribution options to all covered employees.
- 3) The cash balance floor plan and money purchase offset plan each must benefit the same employees.
- 4) Either of the following alternative requirements for nondiscrimination in amounts may be met:
 - a) The cash balance floor plan, without taking into account the offset, must satisfy the DB plan safe harbor uniformity requirements⁹ and unit credit safe harbor.¹⁰ The money purchase offset plan must qualify for any DC

⁸ See IRS Reg § 1.401(a)(4)-8(d)(1).

⁹ See IRS Reg § 1.401(a)(4)-3(b)(2).

¹⁰ See IRS Reg § 1.401(a)(4)-3(b)(3).

safe harbor design¹¹ or pass the general test for nondiscrimination in amount of contributions.

- b) The money purchase offset plan must satisfy the uniform allocation DC safe harbor. The cash balance floor plan, without taking into account the offset, must qualify for a DB plan safe harbor design¹² or pass the general test for nondiscrimination in amount of benefits.¹³

The requirements listed in items 1 through 3 above are achievable through the design of the GIDC Plan. The options available for the DB floor plan listed in items 4a and 4b above are problematic for cash balance plans. The compliance requirements for the money purchase offset plan listed in those items do not present the same hurdles.

The DB floor plan compliance requirement listed in item 4a above would require the cash balance floor plan, without taking into account the offset, to satisfy the uniformity and design requirements for a DB plan unit credit safe harbor. Unfortunately, a cash balance plan in general would not be able to meet the unit credit safe harbor requirements which were designed for traditional DB plans with a benefit formula that is a function of service.

The DB floor plan compliance requirement listed in item 4b above would require the cash balance floor plan, without taking into account the offset, to satisfy any DB plan safe harbor design or pass the general test for benefits nondiscrimination. Again, the safe harbor options available were specifically designed for traditional DB plans. One might think a reasonable accommodation for a cash balance plan would be a requirement that the cash balance plan meet the requirements for the cash balance safe harbor testing method's uniform allocation safe harbor, or satisfy the cash balance safe harbor testing method's basic requirements and any DC plan safe harbor design on the basis of the cash balance plan's contribution credits.

Strict adherence to the language set forth in item 4b listed above would only allow for successful DB general testing. Depending on actual contribution credit design, this would be a viable option given that the offset is disregarded, using either:

- Equivalent allocation rates resulting from the actual conversion of cash balance plan normal retirement accrual rates (and most valuable benefit accrual rates, if different) under cross-testing provisions, or

¹¹ See IRS Reg § 1.401(a)(4)-2(b).

¹² See IRS Reg § 1.401(a)(4)-3(b).

¹³ See IRS Reg § 1.401(a)(4)-3(c).

- Actual cash balance plan normal retirement accrual rates (and most valuable benefit accrual rates, if different) directly in the general test for benefits nondiscrimination.

5.3.2 General Testing

Assume the money purchase offset plan is nondiscriminatory in amounts. The key disadvantage to testing the cash balance floor plan outside of the floor-offset safe harbor is that we cannot disregard the offset. On a standalone basis, one would be testing only the net benefit accruals in the cash balance floor plan. These net benefit accruals are based on the relative performance of participants' investments in the money purchase offset plan to the guaranteed investment rate.

Because investments in the money purchase offset plan of a GIDC arrangement are participant-directed, not every participant will trigger the investment guarantee or otherwise cause an increase or decrease in the cash balance floor plan account. There would not be a problem in years where no participant has fallen behind the guaranteed minimum account balance, but otherwise, individual net accrual amounts in the cash balance floor plan resulting from the investment guarantee are unpredictable.

Absent strategies involving other employer-sponsored plans, one may look to permissively aggregate the cash balance floor plan with the money purchase offset plan. The strategy here would be to use available disparities that favor highly compensated employees in the test (e.g. imputed Social Security disparities) to counteract their equivalent contribution additions from the cash balance floor plan.

Other possible measures available to apply to highly compensated employees would be to provide them with a sufficiently lower investment guarantee, provide them with no investment guarantee (i.e., guarantee preservation of principal only) or exclude them from the cash balance floor plan (i.e., no guarantees). Some of these actions may complicate other aspects of GIDC plan design. If highly compensated employees are excluded from the cash balance floor plan, a possible compensatory measure may be to integrate money purchase offset plan contributions with Social Security so that primarily highly compensated employees only would benefit.

6. True DC Plan Operational Appeal

Participants will likely believe their GIDC plan to be a DC plan that works like other DC plans but with an added ability to actually pay out more than what is accumulated in the participant's actual account if a benchmark account based on the investment guarantee does better on paper. Therefore, upon or after separation from service or death, participants electing a full lump-sum payment from the GIDC plan will expect that their residual guaranteed account balance (based on the GIDC investment guarantee), if any, will be distributed in cash along with their actual money purchase plan account balance.

To expect this "true DC plan" operational feature with respect to the lump-sum provision of a GIDC plan is not unreasonable and will likely be a key design feature of a GIDC plan desired by most plan sponsors. However, because the lump sum under the cash balance floor plan is based on the accrued benefit, there are actuarial mechanics to deal with behind the scene. Appendix B demonstrates that a GIDC plan has this true DC plan operational appeal with respect to its lump-sum provision if the following conditions are met:

- The cash balance floor plan utilizes a safe harbor crediting interest rate as provided for under IRS Notice 96-8.
- The cash balance floor plan's lump-sum basis uses the following preretirement and postretirement sets of assumptions: (1) preretirement interest assumption equal to the crediting interest rate and no preretirement mortality, (2) postretirement interest and mortality assumptions are equal to the plan's statutory minimum lump-sum basis applicable interest and mortality assumptions.

For GIDC plans with annuity provisions, a partial or full annuity option may be elected instead of a full lump-sum payment. In this situation, whether or not a distribution is due from the cash balance floor plan, the immediate or deferred annuity amount offered under the money purchase offset plan would be the amount that could be purchased with the vested account balance from an insurer meeting the "safest available" guidelines of the U.S. Department of Labor.

If an immediate or deferred annuity distribution is also elected from the cash balance floor plan as a result of a positive residual guaranteed account balance, that annuity will be based on the cash balance floor plan's accrued benefit. However, participants would expect the annuity distribution under the cash balance floor plan to be

determined like it would be under the money purchase offset plan.

Appendix B shows that a GIDC plan will, in fact, have this true DC plan operational appeal with respect to its partial or full annuity provisions if, in addition to the cash balance floor plan's crediting rate and plan lump-sum basis conditions stated above, the following conditions are met:

- The cash balance floor plan's basis for annuity early commencement reductions and late commencement increases to the normal retirement benefit is equal to the cash balance floor plan's lump-sum basis.
- The plan sponsor has received approval to allow separated GIDC plan participants to transfer their money purchase offset plan account balances to the cash balance floor plan for annuitization.

7. Cash Balance Floor Plan Current Liability

Consider a GIDC plan with true DC plan operational appeal and with a cash balance floor plan that has a life annuity normal form of payment. Using the notation established in Appendix B with respect to a participant with attained age x and normal retirement age NRA , assume that the cash balance account balance (i.e., the guaranteed account balance) is not less than the money purchase offset plan account balance so that benefits are payable from the cash balance floor plan.

IRS Notice 90-11 requires that current liability assumptions be used instead of plan assumptions to determine the amount of benefits payable under payment forms other than life-based nondecreasing annuities. In Appendix C, the expressions presented below are developed for a single assumed retirement age $XRA \leq NRA$ based on the requirements of IRS Notice 90-11.

The current liability for a participant currently age x with respect to separation at XRA in a GIDC plan with true DC plan operational appeal can be expressed as follows:

- For an assumed lump-sum distribution:

$$(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * \left(\frac{\ddot{a}_{NRA}^{(12)}}{p \ddot{a}_{NRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x}{1 + {}_c i_x} \right)^{NRA-x}$$

- For an assumed distribution of a life-based nondecreasing annuity in payment form F:

$$(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * \left(\frac{\hat{p} fac_{XRA}^{LA \rightarrow F}}{c fac_{XRA}^{LA \rightarrow F}} \right) * \left(\frac{c \ddot{a}_{XRA}^{(12)}}{\hat{p} \ddot{a}_{XRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x^*}{1 + c j_x} \right)^{XRA-x}$$

where the left subscripts p , \hat{p} , and c denote the plan's lump-sum basis, the plan's annuity conversion basis and the current liability basis, respectively; $c j_x$ denotes the current liability interest rate in effect as of the participant's age x ; λ_x^* is the last known value of the crediting interest rate as of the participant's age x ; and $fac_y^{F1 \rightarrow F2}$ denotes the annuity conversion factor between payment forms F1 and F2, both with commencement age y .

Two key observations can be made in regards to the above expressions. First, if the cash balance guaranteed account balance happens not to exceed the money purchase offset plan account balance, current liability is zero.

Second, current liability as a percentage of the residual guaranteed account balance is expected to be rather stable as market interest rates change, provided perhaps, there is no significant reshaping of the Treasury yield curve since safe harbor crediting interest rates (with associated margins) approximate 30-year Treasury yields.

Note that the differences in postretirement mortality are clearly invariant to market interest rate changes for a fixed distribution age. Table 4 together with the discussion below will help illustrate these observations.

The cash balance floor plan's lump-sum basis preretirement interest assumption, λ_x^* , is a safe harbor crediting interest rate as provided under IRS Notice 96-8 and, as such, is "equivalent" to the 30-year Treasury constant maturities yield possibly minus a fixed number of interest rate basis points. Also, the postretirement interest assumption under the cash balance floor plan's lump-sum basis is the 30-year Treasury constant maturities yield used in the plan's statutory minimum lump-sum basis. Therefore, both of the interest assumptions used in the cash balance floor plan's lump-sum basis are correlated to 30-year Treasury constant maturities rates.

The interest assumptions for the OBRA87 and RPA94 current liability bases are a corridor percentage of a four-year average of 30-year Treasury constant maturities rates while the PBGC current liability basis currently uses 85% of a 30-year Treasury constant maturities rate. With those percentages held constant, the ratio of current liability to the

residual guaranteed account balance given by

$$\left(\frac{{}_c\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_{NRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x^*}{1 + {}_c i_x} \right)^{NRA-x}$$

for the assumed lump-sum distribution, and

$$\left(\frac{{}_p fac_{XRA}^{LA \rightarrow F}}{{}_c fac_{XRA}^{LA \rightarrow F}} \right) * \left(\frac{{}_c\ddot{a}_{XRA}^{(12)}}{{}_p\ddot{a}_{XRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x^*}{1 + {}_c i_x} \right)^{XRA-x}$$

for the assumed annuity distribution, each possess a self-immunizing property due to the fact that all discount and interest factors are correlated to the 30-year Treasury constant maturities yield.

Table 5 illustrates this self-immunizing property for the assumed lump-sum distribution and Table 6 does the same for the assumed annuity distribution. First, referring to Table 4 for the comparison of assumptions, further assume for the calculations in Tables 5 and 6 the following:

- The OBRA87 and RPA94 corridor percentages of 110% and 105% times the four-year average of 30-year Treasury yields equals approximately 105% and 100% of the current 30-year Treasury constant maturities yield, respectively, and the OBRA87 mortality assumption is 83GAM.
- The cash balance floor plan's annuity conversion basis is 8% and UP84 mortality setback is three years at all ages.
- The cash balance floor plan's crediting interest rate is based on the one-year Treasury constant maturities yield which is assumed to be equivalent to the current 30-year Treasury constant maturities yield less 100 basis points.
- The calculations are for a male currently age 40.

To illustrate the self-immunizing property, Tables 5 and 6 show the percentage increase or decrease in the participant's cash balance floor plan current liability when the 30-year Treasury constant maturities yield changes from a 6% baseline assumption. For comparison purposes, also shown are illustrative percentage changes in current liability (bearing the stated duration) for a traditional pension plan when the 30-year Treasury constant maturities yield changes from a 6% baseline assumption.

Since the cash balance floor plan may credit interest based on a Treasury rate for maturity periods less than 30 years, a significant reshaping of the Treasury yield curve over the same period defining the change in the 30-year Treasury constant maturities yield could distort the self-immunizing effect.

8. PBGC Premium Requirements

The cash balance floor plan, being a DB plan, is required to be covered by PBGC plan termination insurance, unless the plan meets one of the statutory exemptions from coverage. A covered single-employer plan is required to pay a flat-rate premium of \$19 per participant counted on the premium snapshot date.

A covered single-employer plan is also required to pay a variable-rate annual premium of 0.9% of the plan's unfunded "vested PBGC current liability" determined as of the premium snapshot date, unless the plan otherwise qualifies for an exemption from the variable-rate premium. PBGC current liability is IRC § 412(l) current liability based on an applicable PBGC interest rate.

Based on the analysis of the calculation of current liability in Section 7 of this paper, the PBGC current liability for a cash balance floor plan with a variable index crediting interest rate will be equal to the sum of individual residual guaranteed account balances on the date of determination, each times a stable factor which will be to a large degree invariant to market interest rate changes. For a cash balance floor plan with a fixed crediting interest rate, PBGC current liability will act much like that for some traditional DB plans with respect to market interest rate changes.

If the cash balance floor plan is not exempt from the variable-rate premium, one may be able to determine if the general rule or alternative calculation would produce a lower variable-rate premium based on the mechanics of the alternative calculation and the nature of PBGC current liability.

The general rule calculation involves a vested PBGC current liability determination and the actuarial value of assets on the premium snapshot date. The alternative calculation involves an estimate of vested PBGC current liability as of the premium snapshot date based on vested current liability reported on the prior plan year's IRS Form 5500 Schedule B attachment. The alternative calculation also involves an estimate of the actuarial value of assets as of the premium snapshot date based on the plan's actuarial value of assets reported on the same Schedule B.

The alternative calculation adjusts the plan's vested RPA94 current liability previously reported on the IRS Form 5500 Schedule B attachment for the difference between the plan's RPA94 current liability interest rate used for the prior year and the current premium payment year's applicable PBGC interest rate.

For cash balance floor plans with a fixed crediting interest rate, the alternative calculation's interest rate adjustment mechanism is warranted to the same degree as for traditional DB plans as it adjusts for annuity valuation and discounting differences resulting from different current liability interest rates. However, for cash balance floor plans with a variable index crediting interest rate, the alternative calculation adjustment mechanism for different discount rates does not account for future interest crediting differences that have occurred due to changing 30-year Treasury yields, which is part of the self-immunization property for current liability discussed in Section 7.

In addition to the interest rate adjustment, the alternative calculation requires a 7% increase in nonretiree liability to account for annual benefit accruals. However, accrued benefits in a cash balance floor plan can increase or decrease, depending upon general money purchase offset plan participant investment returns versus the guaranteed investment rate. For a cash balance floor plan with a fixed crediting interest rate, the 7% accrual requirement versus general increases or decreases in residual guaranteed account balances could be the basis for deciding between the alternative calculation or the general rule assuming there were no significant asset gains or losses over the last year.

However, for a cash balance floor plan with a variable index crediting interest rate, the alternative calculation's discount rate adjustment and the self-immunization property of current liability must also be considered. Accordingly, the following observations could help one choose between the alternative calculation or the general rule assuming there were no significant asset gains or losses over the last year:

- If 30-year Treasury yields have increased substantially, the alternative calculation will likely produce a lower variable premium as long as residual guaranteed account balances have not decreased on average.
- If 30-year Treasury yields have not increased substantially, the general rule will likely produce a lower variable premium as long as residual guaranteed account balances have not increased on average.

9. Miscellaneous Considerations

9.1 Employer Involvement in Money Purchase Offset Plan Investments

9.1.1 Participants' Investment Universe and Education

With the support of guaranteed minimum account balances, money purchase offset plan participant investors may be willing to accept more investment risk. However, even with the investment guarantee, a participant investor assuming unreasonable levels of investment risk may not terminate or retire with a larger GIDC account balance than would a comparable participant investor adopting a balanced or conservative investment style.

In fact, the example projection in Table 3 reveals upon examination that a participant with a conservative investment style who terminated during the 34-year period after beginning participation in the initial year would have left with a larger or equally large GIDC account balance in 28 out of the 34 years compared to the balanced or aggressive investment styles.

In addition, the largest GIDC account balance produced (in the last year of the projection) was based on a balanced investment style. Moreover, the largest residual guaranteed account balances, which represent potential employer liabilities, are all associated with the aggressive investment style.

Of course, different results will occur with different investment styles and/or periods of investment history. However, the above observations do underscore two important related points. First, even with the investment guarantee, investment education remains important to improve the potential long-term upside for the participant.

Second, in conjunction with investment education, the employer should structure the participants' investment universe in the money purchase offset plan to prevent participant investors from assuming unreasonable levels of investment risk since the employer is subject to the downside of that risk. Subject to limitations under ERISA § 404(c), this may involve limiting investment election percentages for certain investment options or combination of investment options.

9.1.2 Employer-Directed Investments

There is no requirement that money purchase offset plan investments be directed by participants. The GIDC plan has been introduced based on participant direction of money purchase offset plan investments mainly because participant direction is popular. An additional reason is participants in general are more risk averse than employers, thereby more often requiring some support before deviating from rather conservative positions.

Employer-directed investments in the money purchase offset plan would provide all money purchase offset plan participants the same time-weighted investment return earned in each year by the employer, subject to the cumulative long-term guaranteed investment return supported by the cash balance floor plan. One advantage to employer direction of money purchase offset plan investments may be the ability of the employer to control downside risks while still seeking a return in excess of the guaranteed investment rate, thereby minimizing required funding for the cash balance floor plan.

One strategy toward the accomplishment of this result we will term “near-retirement stabilization.” Before discussing that strategy, first note that participants may have a residual guaranteed minimum account balance at any age. However, older participants have limited remaining time for their money purchase offset plan account balance to grow fast enough to eliminate a residual guaranteed account balance before their retirement. In addition, it is the older “near-retirement” participants who would most likely trigger or increase funding to the cash balance floor plan because the leveraged funding characteristic of cash balance plans is less effective at older ages (Lowman 2000).

The basic near-retirement stabilization strategy is to invest a sufficient portion of money purchase offset plan assets in the securities defining the GIDC investment guarantee. The amount invested should cover the aggregate money purchase offset plan account balances of all participants over some near-retirement age. The remaining money purchase offset plan assets are actively managed in efforts to achieve a total return in excess of the guaranteed investment rate.

9.2 Changes to the Guaranteed Investment Rate

In a frontloaded interest credit cash balance plan, future interest credits associated with contribution credits received are part of the accrued benefit and can not be reduced by plan amendment below those required under the definition of the crediting interest

rate in effect when the contribution credits were accrued in order to prevent a prohibited forfeiture of benefits.

Therefore, unless an unambiguously better guaranteed investment rate is implemented by a plan change, the prior guaranteed investment rate will not immediately be displaced. The account balances as of the date of plan amendment must continue to be credited interest under the prior crediting interest rate structure until distributed. Only contributions credited after the date of plan amendment may credited interest under the new crediting interest rate structure.

The phrase “unambiguously better guaranteed investment rate” is used as a precaution. IRS Notice 96-8 provides a list of variable indexes and associated maximum margins that are assumed to be equivalent to the 30-year Treasury constant maturities yield for purposes of satisfying statutory minimum lump-sum requirements. That allowance may not apply for IRC § 11(d)(6) anti-cutback purposes.

Appendix A

Cash Balance Plan Statutory Minimum Lump Sums

Assuming birthdays on Jan. 1, let λ_{AA} be the current value of the cash balance floor plan's crediting interest rate index applicable for a participant with attained age "AA" and normal retirement age "NRA." Let "AccountBalance_{AA}" denote the value of the cash balance account as of the day before the attainment of "AA." Also, let the left subscripts "p" and "s" indicate an actuarial function based on the "plan's lump-sum basis" and "statutory minimum lump-sum (GATT) basis."

Then, assuming the cash balance plan's normal form of payment is a life annuity, the cash balance plan account balance (assumed to be fully vested) will be at least as large as the statutory minimum lump-sum value if

$$\frac{\text{AccountBalance}_{AA} * (1 + \lambda_{AA})^{(NRA - AA)}}{{}_p \ddot{a}_{NRA}^{(12)}} * {}_s \ddot{a}_{NRA}^{(12)} * \frac{{}_s D_{NRA}}{{}_s D_{AA}} \leq \text{AccountBalance}_{AA}$$

(A1)

The expression in Equation (A1) can be reduced to

$$\frac{{}_s \ddot{a}_{NRA}^{(12)}}{{}_p \ddot{a}_{NRA}^{(12)}} * \frac{{}_s \ell_{NRA}}{{}_s \ell_{AA}} * \left(\frac{1 + \lambda_{AA}}{1 + {}_s j_{AA}} \right)^{(NRA - AA)} \leq 1$$

(A2)

where ${}_s j_{AA}$ is the statutory minimum lump-sum basis applicable interest rate in effect at the participant's attained age and ${}_s \ell_x$ is the expected number of lives surviving to age x for a fixed cohort subject to mortality based on the statutory minimum lump-sum basis applicable mortality assumption.

Note that the following two conditions, if both met, are sufficient to satisfy Equation (A2) and, hence, Equation (A1):

$$\frac{{}_s\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_{NRA}^{(12)}} * \frac{{}_s\ell_{NRA}}{{}_s\ell_{AA}} \leq 1$$

(A3)

and

$$\frac{1 + \lambda_{AA}}{1 + {}_s i_{AA}} \leq 1 \quad \text{or} \quad \lambda_{AA} \leq {}_s i_{AA}.$$

(A4)

Thus, for an appropriate choice for the plan's lump-sum basis (condition A3), a cash balance plan may pay out the account balance value as long as $\lambda_k \leq {}_s i_k$ for all years k and for all participants (condition A4). With the expectation that an appropriate plan lump-sum basis exists, IRS Notice 96-8 provides a set of safe harbor indices plus maximum associated margins that, if used as the cash balance plan's crediting interest rate, would provide the plan-deemed compliance with the statutory minimum lump-sum requirements, provided that the account balance is distributed.

Under IRS Notice 96-8, a safe harbor index plus the maximum associated margin is considered equivalent to the 30-year Treasury constant maturities yield. Therefore, a safe harbor index plus a margin not exceeding the maximum margin associated with the index satisfies condition (A4). The trap, which is most troublesome when $\lambda_{AA} \approx {}_s i_{AA}$, is making an appropriate choice for the plan's lump-sum basis, presumably one that satisfies condition (A3).

To illustrate this situation, consider a plan with an IRC § 417(e)(3) statutory minimum lump-sum basis of the applicable unisex version of the 83GAM Table ("U83GAM") and a 30-year constant maturities Treasury yield with a current value of 6% (i.e., ${}_s i_{AA} = 6\%$). Further assume the plan's normal form is a life annuity, NRA is age 65, and the plan's crediting interest rate is equal to its IRC § 417(e)(3) interest rate (i.e., $\lambda_{AA} = {}_s i_{AA}$); that is, the crediting interest rate is a 30-year Treasury constant maturities yield. Note that the choice of the plan's lump basis will affect the ratio " ${}_s\ddot{a}_{NRA}^{(12)} / {}_p\ddot{a}_{NRA}^{(12)}$ " but not the ratio " ${}_s\ell_{NRA} / {}_s\ell_{AA}$ " in condition (A3).

Table 7 presents the calculated results for the left-hand side of condition (A3) for our assumed plan. The plan's lump-sum basis is alternatively assumed to be based on an interest assumption of 5%, 6%, or 8% and a mortality assumption of either the UP84 Table ("UP84") or the unisex version of the 83GAM Table ("U83GAM").

As a general observation, for a plan using a safe harbor crediting interest rate under IRS Notice 96-8 and a plan lump-sum basis mortality assumption equal the applicable mortality assumption under that plan's statutory minimum lump-sum basis, the plan's lump-sum basis interest assumption may not exceed the plan's statutory minimum lump-sum basis 30-year Treasury constant maturities yield.

If the plan's lump-sum basis has higher rates of mortality than U83GAM, then the plan's lump-sum basis interest assumption should be sufficiently less than the plan's statutory minimum lump-sum basis 30-year Treasury constant maturities yield. As a final observation, note that since $\frac{s^{\ell}_{NRA}}{s^{\ell}_{AA}} \leq 1$, it would be sufficient to satisfy $\frac{s^{\ddot{a}}_{NRA}^{(12)}}{p^{\ddot{a}}_{NRA}^{(12)}} \leq 1$, which is the last row in Table 7.

Appendix B

Sufficient Conditions for “True DC Plan Operational Appeal”

Let $CBAcctBal_{x,k}$ and $MPAcctBal_{x,k}$ denote the accumulated account balances under a GIDC plan from the cash balance floor plan (prior to offset) and the money purchase offset plan with contribution credits or contributions to age x and known interest credits or investment earnings to age k ($x \leq k$), respectively. Assume $CBAcctBal > MPAcctBal$ so that there are benefits payable from the cash balance floor plan, which has a life annuity normal form of payment.

Let $CBFPis_x$ denote the net lump sum payable under the cash balance floor plan at age x based on $CBAcctBal_{x,x}$ and $MPAcctBal_{x,x}$. Then, let $CBFPann_{x,y}^{LA(y)}$ denote the net life annuity under the cash balance floor plan commencing at age $y \leq NRA$ based on $CBAcctBal_{x,y}$ and $MPAcctBal_{x,y}$. Finally, let (i) $fac_y^{F1 \rightarrow F2}$ denote the factor under the cash balance floor plan’s annuity conversion basis that converts an annuity in payment form $F1$ to an annuity in payment form $F2$, both annuities commencing at age y , and (ii) ${}_p\ddot{a}_y^{F(12)}$ denote the annuity factor under the plan’s lump-sum basis for an annuity in payment form F commencing at age y , but still keeping the notation ${}_p\ddot{a}_y^{(12)}$ when $F = \text{Life Annuity}$.

Provided GIDC plan participants are allowed to transfer their money purchase offset plan account balances to the cash balance floor plan for annuitization, then:

- The lump-sum distribution payable under the GIDC plan at age x is given by

$$CBFPis_x + MPAcctBal_{x,x}.$$

- The partial annuity distributions under the GIDC plan, with the annuity elected to be in payment form F , commencing at age y , where $x \leq y$, is given by

$$CBFPis_x + \frac{MPAcctBal_{x,y}}{{}_p\ddot{a}_y^{F(12)}}$$

or

$$CBFPann_{x,y}^{LA(y)} * fac_y^{LA \rightarrow F} + MPActBal_{x,x}.$$

- The full annuity distribution under the GIDC plan, with the annuity elected to be in payment form F , commencing at age y , where $x \leq y$, can be expressed by

$$CBFPann_{x,y}^{LA(y)} * fac_y^{LA \rightarrow F} + \frac{MPActBal_{x,y}}{F * \ddot{a}_y^{(12)}}.$$

Thus, in order to show that a GIDC plan has true DC plan operational appeal, as outlined in Section 6 of this paper, it is sufficient to show the following:

- $CBFPis_x = CBAcctBal_{x,x} - MPActBal_{x,x}$
- $CBFPann_{x,y}^{LA(y)} = \frac{(CBAcctBal_{x,x} - MPActBal_{x,x}) * (1 + \lambda)^{y-x}}{p \ddot{a}_y^{(12)}} (for a partial annuity distribution from the cash balance floor plan)$
- $CBFPann_{x,y}^{LA(y)} = \frac{CBAcctBal_{x,y} - MPActBal_{x,y}}{p \ddot{a}_y^{(12)}}$

(for the portion of a full annuity distribution from the cash balance floor plan), where λ is the cash balance floor plan's crediting interest rate with the understanding that if it is based on variable index values, the appropriate index values are used for the appropriate time periods.

The propositions below will present and prove sufficient conditions to achieve a true DC plan operational appeal with respect to a cash balance floor plan's lump-sum and annuity provisions. The proofs below consider distributions commencing no later than NRA. It is left to the reader to verify that similar results occur for late commencements.

Proposition 1

Given the above structure, a GIDC plan has a true DC plan operational appeal with respect to its lump-sum provision, provided that the following conditions are met:

- The cash balance floor plan utilizes a safe harbor crediting interest rate as provided for under IRS Notice 96-8.

- The cash balance floor plan’s lump-sum basis uses the following preretirement and postretirement sets of assumptions:
 - Preretirement interest assumption equal λ_x^* and no preretirement mortality, where λ_x^* represents the last known value of the crediting interest rate as of the date of lump-sum determination at age x .
 - Postretirement interest and mortality assumptions are equal to the plan’s statutory minimum lump-sum basis applicable interest and mortality assumptions.

Proof

Let the left subscripts “ p ” and “ s ” indicate an actuarial function based on the “plan’s lump-sum basis” and “statutory minimum lump-sum (GATT) basis.” Recall the cash balance floor plan accrued benefit before offset at age x is given by

$$\frac{CBAcctBal_{x,x} * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}}.$$

The offset provided by the money purchase offset plan is the life annuity at NRA equivalent to $MPAcctBal_{x,x}$, determined under the cash balance floor plan’s lump-sum basis. Since the preretirement assumptions for the cash balance floor plan’s lump-sum basis are an interest assumption of λ_x^* and no mortality, the offset can be expressed by

$$\frac{MPAcctBal_{x,x}}{{}_p\ddot{a}_{NRA}^{(12)} * \frac{1}{(1 + \lambda_x^*)^{NRA-x}}} = \frac{MPAcctBal_{x,x} * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}}.$$

Therefore, the normal form annuity at NRA provided under the cash balance floor plan as of age x is

$$CBFPann_{x,x}^{LA(NRA)} = \frac{CBAcctBal_{x,x} * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}} - \frac{MPAcctBal_{x,x} * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}}.$$

(B1)

Based on the result in Equation (B1), the cash balance floor plan's lump-sum value is

$$\begin{aligned}
 & CBF\text{Pann}_{x,x}^{LA(NRA)} * {}_p\ddot{a}_{NRA}^{(12)} * \frac{{}_pD_{NRA}}{{}_pD_x} = \\
 & \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{{}_p\ddot{a}_{NRA}^{(12)}} * {}_p\ddot{a}_{NRA}^{(12)} * \frac{1}{(1 + \lambda_x^*)^{NRA-x}} \\
 & = CBAcctBal_{x,x} - MPAcctBal_{x,x}.
 \end{aligned}
 \tag{B2}$$

Now we need to verify that the cash balance floor plan's statutory minimum lump-sum value of $CBFPann_{x,x}^{LA(NRA)}$ is not greater than Equation (B2). According to Appendix A, it is sufficient to show that

$$\frac{{}_s\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_{NRA}^{(12)}} * \frac{{}_s\ell_{NRA}}{{}_s\ell_x} \leq 1
 \tag{B3}$$

and

$$\lambda_x^* \leq {}_s i_x.
 \tag{B4}$$

Condition (B4) follows from the cash balance floor plan utilizing a safe harbor crediting interest rate as provided for under IRS Notice 96-8. With respect to condition (B3), since $\frac{{}_s\ell_{NRA}}{{}_s\ell_x} \leq 1$, it will be sufficient to show that $\frac{{}_s\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_{NRA}^{(12)}} \leq 1$. However, the plan's postretirement lump-sum basis is equal to the plan's postretirement statutory minimum lump-sum basis; thus, $\frac{{}_s\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_{NRA}^{(12)}} = 1$, and therefore condition (B3) follows.

Proposition 2

A GIDC plan has a true DC plan operational appeal with respect to its annuity provisions, provided that the conditions stated in Proposition 1 are met as well as the following condition: The cash balance floor plan's basis for annuity early commencement reductions is equal to the cash balance floor plan's lump-sum basis.

Proof

First, the partial annuity distribution from the cash balance floor plan at age y can be expressed by

$$CBFPann_{x,y}^{LA(y)} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda)^{y-x}}{p \ddot{a}_y^{(12)}}.$$

At separation age x , the money purchase offset plan account balance, $MPAcctBal_{x,x}$, is distributed, deferring the cash balance floor plan's accrued benefit as of age x for later commencement (in some selected annuity form) at age y where $x \leq y \leq NRA$. From Equation (B1) in Proposition 1, we have at separation age x ,

$$CBFPann_{x,x}^{LA(NRA)} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{p \ddot{a}_{NRA}^{(12)}}.$$

(B5)

When ready to begin annuity payments $y - x$ years later, the accrued benefit in Equation (B5) will be expressed as

$$CBFPann_{x,y}^{LA(NRA)} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda)^{y-x} * (1 + \lambda_x^*)^{NRA-y}}{p \ddot{a}_{NRA}^{(12)}}.$$

(B6)

Using the cash balance floor plan's basis for annuity early commencement reductions, which is assumed to be equal to the cash balance floor plan's lump-sum basis, we reduce Equation (B6) for early commencement at age y :

$$\begin{aligned}
 CBFPann_{x,y}^{LA(NRA)} * \frac{{}_p\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_y^{(12)}} * \frac{{}_pD_{NRA}}{{}_pD_y} &= \\
 \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1+\lambda)^{y-x} * (1+\lambda_x^*)^{NRA-y}}{{}_p\ddot{a}_{NRA}^{(12)}} * \frac{{}_p\ddot{a}_{NRA}^{(12)}}{{}_p\ddot{a}_y^{(12)}} * \frac{1}{(1+\lambda_x^*)^{NRA-y}} & \\
 = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1+\lambda)^{y-x}}{{}_p\ddot{a}_y^{(12)}} . &
 \end{aligned}$$

Now, under the full annuity distribution at age y ,

$$CBFPann_{x,y}^{LA(y)} = \frac{CBAcctBal_{x,y} - MPAcctBal_{x,y}}{{}_p\ddot{a}_y^{(12)}} .$$

At separation age x , the money purchase offset plan account balance, $MPAcctBal_{x,x}$, is not distributed, but rather left in the money purchase offset plan continuing to be invested by the participant until just prior to annuity commencement at age y where $x \leq y \leq NRA$. Similarly, the cash balance account balance at separation age x , $CBAcctBal_{x,x}$, continues to earn interest credits until just prior to annuity commencement at age y . In this situation, the cash balance floor plan accrued benefit at age y is expressed by

$$\frac{CBAcctBal_{x,y} * (1+\lambda_y^*)^{NRA-y}}{{}_p\ddot{a}_{NRA}^{(12)}} .$$

Likewise in this situation, the offset provided by the money purchase offset plan is the life annuity at NRA of $MPAcctBal_{x,y}$ determined under the cash balance floor plan's lump-sum basis, which can be expressed by

$$\frac{MPAcctBal_{x,y}}{{}_p\ddot{a}_{NRA}^{(12)} * \frac{1}{(1+\lambda_y^*)^{NRA-y}}} = \frac{MPAcctBal_{x,y} * (1+\lambda_y^*)^{NRA-y}}{{}_p\ddot{a}_{NRA}^{(12)}} .$$

Therefore, the normal form annuity at NRA provided under the cash balance floor plan as of age y is

$$\begin{aligned}
 CBFPann_{x,y}^{LA(NRA)} &= \frac{CBAcctBal_{x,y} * (1 + \lambda_y^*)^{NRA-y}}{p \ddot{a}_{NRA}^{(12)}} - \frac{MPAcctBal_{x,y} * (1 + \lambda_y^*)^{NRA-y}}{p \ddot{a}_{NRA}^{(12)}} = \\
 &= \frac{(CBAcctBal_{x,y} - MPAcctBal_{x,y}) * (1 + \lambda_y^*)^{NRA-y}}{p \ddot{a}_{NRA}^{(12)}}.
 \end{aligned}
 \tag{B7}$$

Using the cash balance floor plan's basis for annuity early commencement reductions, which is assumed to be equal to the cash balance floor plan's lump-sum basis, we reduce Equation (B7) for early commencement at age y :

$$\begin{aligned}
 CBFPann_{x,y}^{LA(NRA)} &* \frac{p \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_y^{(12)}} * \frac{p D_{NRA}}{p D_y} = \\
 &= \frac{(CBAcctBal_{x,y} - MPAcctBal_{x,y}) * (1 + \lambda_y^*)^{NRA-y}}{p \ddot{a}_{NRA}^{(12)}} * \frac{p \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_y^{(12)}} * \frac{1}{(1 + \lambda_y^*)^{NRA-y}} \\
 &= \frac{CBAcctBal_{x,y} - MPAcctBal_{x,y}}{p \ddot{a}_y^{(12)}}.
 \end{aligned}$$

Appendix C

Cash Balance Floor Plan Current Liability in a GIDC Plan with True DC Plan Operational Appeal

All notation established in Appendix B will be used here for a participant with attained age x and normal retirement age NRA . In addition, the left subscript " c " and " \hat{p} " will denote an actuarial function based on current liability assumptions and the cash balance floor plan's annuity conversion basis, respectively. Current liability valuations will ignore preretirement mortality due to the 100% GIDC death benefit provision.

First, considering an assumed lump-sum distribution form of payment at $XRA \leq NRA$, we start with Equation (B1) from Appendix B, which gives an expression for the life annuity benefit accrued as of age x in the cash balance floor plan:

$$CBFPann_{x,x}^{LA(NRA)} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{p \ddot{a}_{NRA}^{(12)}}.$$

(C1)

Using current liability assumptions to compute the lump-sum value of Equation (C1) as required under IRS Notice 90-11, and then discounting that lump-sum at XRA to current age x using current liability assumptions, we get

$$\begin{aligned} & \left(CBFPann_{x,x}^{LA(NRA)} * c \ddot{a}_{NRA}^{(12)} * \frac{1}{(1 + c i_x)^{NRA-XRA}} \right) * \frac{1}{(1 + c i_x)^{XRA-x}} = \\ & \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{p \ddot{a}_{NRA}^{(12)}} * c \ddot{a}_{NRA}^{(12)} * \frac{1}{(1 + c i_x)^{NRA-x}} \\ & = (CBAcctBal_{x,x} - MPAcctBal_{x,x}) * \left(\frac{c \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_{NRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x^*}{1 + c i_x} \right)^{NRA-x} \end{aligned}$$

which is the first expression presented in Section 7.

Now consider an assumed annuity distribution commencing at $XRA \leq NRA$ in payment form F , a life-based nondecreasing annuity. We start again with Equation (B1) of Appendix B:

$$CBFPann_{x,x}^{LA(NRA)} = \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{p \ddot{a}_{NRA}^{(12)}}.$$

(C2)

Because payment form F is a life-based nondecreasing annuity, IRS Notice 90-11 allows for early commencement reductions as prescribed by the cash balance floor plan. In a GIDC plan with true DC plan operational appeal, the cash balance floor plan's basis for annuity early commencement reductions is the plan's lump-sum basis. Thus, reducing Equation (C2) for early commencement at XRA , we get

$$\begin{aligned} CBFPann_{x,x}^{LA(XRA)} &= CBFPann_{x,x}^{LA(NRA)} * \frac{p \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_{XRA}^{(12)}} * \frac{1}{(1 + \lambda_x^*)^{NRA-XRA}} = \\ &= \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{NRA-x}}{p \ddot{a}_{NRA}^{(12)}} * \frac{p \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_{XRA}^{(12)}} * \frac{1}{(1 + \lambda_x^*)^{NRA-x}} \\ &= \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{XRA-x}}{p \ddot{a}_{XRA}^{(12)}}. \end{aligned}$$

(C3)

Recall that the conversion factor ${}_p fac_{XRA}^{LA \rightarrow F}$, determined under the cash balance floor plan's annuity conversion basis, will convert the life annuity in (C3) to an equivalent annuity in payment form F , both commencing at XRA . Performing that conversion and then valuing the resulting annuity using current liability assumptions yields the following:

$$\begin{aligned} CBFPann_{x,x}^{LA(XRA)} * {}_p fac_{XRA}^{LA \rightarrow F} * {}_c \ddot{a}_{XRA}^{(12)} * \frac{1}{(1 + {}_c j_x)^{XRA-x}} &= \\ \frac{(CBAcctBal_{x,x} - MPAcctBal_{x,x}) * (1 + \lambda_x^*)^{XRA-x}}{p \ddot{a}_{XRA}^{(12)}} * {}_p fac_{XRA}^{LA \rightarrow F} * \left(\frac{{}_c \ddot{a}_{XRA}^{(12)}}{{}_c fac_{XRA}^{LA \rightarrow F}} \right) * \frac{1}{(1 + {}_c j_x)^{XRA-x}} &= \\ = (CBAcctBal_{x,x} - MPAcctBal_{x,x}) * \left(\frac{{}_p fac_{XRA}^{LA \rightarrow F}}{{}_c fac_{XRA}^{LA \rightarrow F}} \right) * \left(\frac{{}_c \ddot{a}_{XRA}^{(12)}}{p \ddot{a}_{XRA}^{(12)}} \right) * \left(\frac{1 + \lambda_x^*}{1 + {}_c j_x} \right)^{XRA-x} & \end{aligned}$$

which is the second expression presented in Section 7.

References

Lowman, T.B. 2000. "Actuarial Aspects of Cash Balance Plans." Online at http://www.soa.org/research/actuarial_aspects.pdf.

Table 1
Illustrative Calendar Year GIDC Plan Provisions

| Item | Illustrative GIDC Plan Provisions | |
|---|---|---|
| | Money purchase offset plan (MPOP) | Cash balance floor plan (CBFP) |
| Covered group | All employees | Same |
| Participation provisions: | | |
| - Elig. age/service req. | n/a /1 year | Same |
| - Eligibility service defn. | 1,000 hours | Same |
| - Entry dates | Jan. 1, July 1 | Same |
| Vesting provisions: | | |
| - Vesting schedule | 5-year cliff | Same |
| - Vesting service | 1,000 hours | Same |
| Contribution & contribution credit provisions: | | |
| - EOY contribution/credit | 5% of compensation | Same |
| - Compensation defn. | W-2 + salary deferrals | Same |
| - Hours requirement | 500 Hours | Same |
| - EOY employment req. | None | Same |
| - Disposition of forfeitures | Reduce future employer contributions | Reflected in past/future employer contributions |
| Contribution/credit timing | Deposited Dec. 31 or immediately thereafter | Credited Dec. 31 |
| Administrative expenses | Charged to accounts | Paid from trust |
| Guaranteed investment rate until account distribution | n/a | Crediting interest rate |

(Table 1 continues on the following page.)

Table 1
Illustrative Calendar Year GIDC Plan Provisions (continued)

| Item | Illustrative GIDC Plan Provisions (continued) | |
|--|---|--|
| | Money purchase offset plan | Cash balance floor plan |
| Plan year crediting interest or investment rate | Actual participant-directed net investment return | 1-year treasury constant maturities yield for prior November plus 1.0% |
| 417(e)(3) statutory minimum lump sum basis (plan year stability period) | n/a | 30-year Treasury constant maturities yield for prior November and U83GAM |
| Plan lump sum basis and basis for annuity early/late comm. reductions/incr's | n/a | Preretirement: crediting interest rate/no mortality; postret.: 417(e)(3) basis |
| Normal ret. benefit (NRB) and normal payment form | Account Balance at NRA paid as lump sum | Accrued NRB at NRA paid as life annuity |
| Accrued NRB: - Before offset | Current MPOP account balance with continued actual investment earnings to NRA | Value of the current CBFP acct. balance w/credited interest to NRA converted to life annuity under plan's lump sum basis |
| - Offset | n/a | Current MPOP account balance converted to life annuity at NRA under plan's lump sum basis |
| Death benefit | 100% of account balance | 100% of accrued benefit |
| Actual distributable amts: - Lump-sum payment | Actual vested MPOP account balance | The excess, if any, of the actual vested CBFP plan acct. bal. over the actual vested MPOP acct. bal. |
| - Annuity options | Annuity provided by the transfer of actual vested MPOP acct. bal. to CBFP | Actuarial equivalent annuity to accrued NRB |

Table 2
Example Market Returns and Alternative Participant Investment Styles

| Year | (A) (B) (C) Annual returns (%) for market indexes | | | (D) Guaranteed investment rate [A+1.0%] | (E) (F) (G) Illustrative investment return experience for alternative participant investment styles | | | |
|------|--|----------------------------------|-------------------------|---|--|---|-------------------------------------|---|
| | 1-year | Treas. bills constant maturities | S&P 500 stock composite | | S&P long-term bond composite | Conservative "15% / 85%" [.15*B+.85*C] | Balanced "60% / 40%" [.6*B+.4*C] | Aggressive "85% / 15%" [.85*B+.15*C] |
| | 1962 | 3.14 | (11.81) | | 4.43 | 4.14 | 1.99 | (5.31) |
| 1963 | 3.44 | 18.89 | 4.35 | 4.44 | 6.53 | 13.07 | 16.71 | |
| 1964 | 3.76 | 12.97 | 4.47 | 4.76 | 5.75 | 9.57 | 11.70 | |
| 1965 | 4.09 | 9.06 | 4.55 | 5.09 | 5.23 | 7.26 | 8.38 | |
| 1966 | 5.11 | (13.09) | 5.22 | 6.11 | 2.47 | (5.77) | (10.34) | |
| 1967 | 4.79 | 20.09 | 5.66 | 5.79 | 7.82 | 14.32 | 17.93 | |
| 1968 | 5.54 | 7.65 | 6.31 | 6.54 | 6.51 | 7.11 | 7.45 | |
| 1969 | 6.86 | (11.35) | 7.16 | 7.86 | 4.38 | (3.95) | (8.57) | |
| 1970 | 6.39 | 0.10 | 8.21 | 7.39 | 6.99 | 3.34 | 1.32 | |
| 1971 | 4.64 | 10.79 | 7.65 | 5.64 | 8.12 | 9.53 | 10.32 | |
| 1972 | 4.82 | 15.63 | 7.51 | 5.82 | 8.73 | 12.38 | 14.41 | |
| 1973 | 7.16 | (17.37) | 7.70 | 8.16 | 3.94 | (7.34) | (13.61) | |
| 1974 | 7.72 | (29.70) | 8.43 | 8.72 | 2.71 | (14.45) | (23.98) | |
| 1975 | 6.37 | 31.51 | 8.91 | 7.37 | 12.30 | 22.47 | 28.12 | |
| 1976 | 5.62 | 19.15 | 8.57 | 6.62 | 10.16 | 14.92 | 17.56 | |
| 1977 | 5.70 | (11.50) | 8.33 | 6.70 | 5.36 | (3.57) | (8.53) | |
| 1978 | 7.68 | 1.06 | 8.93 | 8.68 | 7.75 | 4.21 | 2.24 | |
| 1979 | 9.77 | 12.31 | 9.80 | 10.77 | 10.18 | 11.31 | 11.93 | |
| 1980 | 10.75 | 25.77 | 12.02 | 11.75 | 14.08 | 20.27 | 23.71 | |
| 1981 | 13.16 | (9.77) | 14.32 | 14.16 | 10.71 | (0.13) | (6.16) | |
| 1982 | 11.10 | 14.81 | 13.73 | 12.10 | 13.89 | 14.38 | 14.65 | |
| 1983 | 8.86 | 17.27 | 11.86 | 9.86 | 12.67 | 15.11 | 16.46 | |
| 1984 | 9.91 | 1.40 | 12.94 | 10.91 | 11.21 | 6.02 | 3.13 | |
| 1985 | 7.76 | 26.33 | 11.41 | 8.76 | 13.65 | 20.36 | 24.09 | |
| 1986 | 6.07 | 14.62 | 9.40 | 7.07 | 10.18 | 12.53 | 13.84 | |
| 1987 | 6.33 | 2.03 | 9.66 | 7.33 | 8.52 | 5.08 | 3.17 | |
| 1988 | 7.17 | 12.40 | 9.93 | 8.17 | 10.30 | 11.41 | 12.03 | |
| 1989 | 7.91 | 27.25 | 9.46 | 8.91 | 12.13 | 20.13 | 24.58 | |
| 1990 | 7.36 | (6.56) | 9.67 | 8.36 | 7.24 | (0.07) | (4.13) | |
| 1991 | 5.54 | 26.31 | 9.14 | 6.54 | 11.72 | 19.44 | 23.73 | |
| 1992 | 3.75 | 4.46 | 8.61 | 4.75 | 7.99 | 6.12 | 5.08 | |
| 1993 | 3.33 | 7.06 | 7.77 | 4.33 | 7.66 | 7.34 | 7.17 | |
| 1994 | 5.02 | (1.54) | 8.05 | 6.02 | 6.61 | 2.30 | (0.10) | |
| 1995 | 5.69 | 34.11 | 7.54 | 6.69 | 11.53 | 23.48 | 30.12 | |
| 1996 | 5.23 | 20.26 | 7.49 | 6.23 | 9.41 | 15.15 | 18.34 | |

TABLE 3 Illustrative GIDC Plan Account Balances Projection

| Year | CPI-U ann. % change | Participant GIDC plan information | | | Illustrative participant net account balances under the GIDC money purchase offset & cash balance floor plans | | | | | |
|------|---------------------------|---|---|--|--|------------------------|-------------------------|------------------------|-------------------------|------------------------|
| | | Annual plan compensation [inc=CPI-U+1.0%] | End-of-year contribution/ contrib. credit | Guaranteed min. cash balance account balance | Conservative investor | | Balanced investor | | Aggressive investor | |
| | | | | | MP offset acct. bal. | CB floor acct. bal. | MP offset acct. bal. | CB floor acct. bal. | MP offset acct. bal. | CB floor acct. bal. |
| | | | | | | | | | | |
| 1962 | 1.00 | 15,000 | 750 | 750 | 750 | - | 750 | - | 750 | - |
| 1963 | 1.32 | 15,300 | 765 | 1,548 | 1,564 | - | 1,613 | - | 1,640 | - |
| 1964 | 1.31 | 15,655 | 783 | 2,405 | 2,437 | - | 2,550 | - | 2,615 | - |
| 1965 | 1.61 | 16,017 | 801 | 3,328 | 3,365 | - | 3,536 | - | 3,635 | - |
| 1966 | 2.86 | 16,435 | 822 | 4,353 | 4,270 | 83 | 4,154 | 199 | 4,081 | 272 |
| 1967 | 3.09 | 17,069 | 853 | 5,459 | 5,457 | 1 | 5,602 | - | 5,666 | - |
| 1968 | 4.19 | 17,767 | 888 | 6,704 | 6,701 | 3 | 6,889 | - | 6,976 | - |
| 1969 | 5.46 | 18,689 | 934 | 8,165 | 7,929 | 236 | 7,552 | 614 | 7,312 | 853 |
| 1970 | 5.72 | 19,897 | 995 | 9,764 | 9,478 | 285 | 8,799 | 965 | 8,403 | 1,360 |
| 1971 | 4.38 | 21,234 | 1,062 | 11,376 | 11,310 | 66 | 10,700 | 676 | 10,332 | 1,044 |
| 1972 | 3.21 | 22,376 | 1,119 | 13,157 | 13,416 | - | 13,143 | 14 | 12,940 | 217 |
| 1973 | 6.22 | 23,318 | 1,166 | 15,396 | 15,110 | 286 | 13,344 | 2,052 | 12,345 | 3,051 |
| 1974 | 11.04 | 25,002 | 1,250 | 17,989 | 16,770 | 1,219 | 12,666 | 5,323 | 10,635 | 7,354 |
| 1975 | 9.13 | 28,012 | 1,401 | 20,715 | 20,233 | 482 | 16,913 | 3,802 | 15,026 | 5,689 |
| 1976 | 5.76 | 30,849 | 1,542 | 23,629 | 23,831 | - | 20,978 | 2,651 | 19,207 | 4,422 |
| 1977 | 6.50 | 32,935 | 1,647 | 26,859 | 26,754 | 105 | 21,877 | 4,982 | 19,216 | 7,642 |
| 1978 | 7.59 | 35,405 | 1,770 | 30,961 | 30,597 | 363 | 24,567 | 6,393 | 21,417 | 9,543 |
| 1979 | 11.35 | 38,446 | 1,922 | 36,217 | 35,633 | 584 | 29,267 | 6,950 | 25,895 | 10,322 |
| 1980 | 13.50 | 43,194 | 2,160 | 42,633 | 42,811 | - | 37,360 | 5,273 | 34,194 | 8,438 |
| 1981 | 10.32 | 49,457 | 2,473 | 51,142 | 49,867 | 1,275 | 39,782 | 11,360 | 34,562 | 16,580 |
| 1982 | 6.16 | 55,056 | 2,753 | 60,083 | 59,548 | 535 | 48,255 | 11,828 | 42,377 | 17,706 |
| 1983 | 3.21 | 58,998 | 2,950 | 68,957 | 70,043 | - | 58,494 | 10,463 | 52,302 | 16,655 |
| 1984 | 4.32 | 61,482 | 3,074 | 79,555 | 80,969 | - | 65,088 | 14,467 | 57,014 | 22,541 |
| 1985 | 3.56 | 64,753 | 3,238 | 89,761 | 95,257 | - | 81,578 | 8,183 | 73,987 | 15,774 |
| 1986 | 1.86 | 67,705 | 3,385 | 99,493 | 108,342 | - | 95,187 | 4,306 | 87,610 | 11,883 |
| 1987 | 3.65 | 69,642 | 3,482 | 110,267 | 121,050 | - | 103,506 | 6,761 | 93,873 | 16,394 |
| 1988 | 4.14 | 72,880 | 3,644 | 122,920 | 137,163 | - | 118,963 | 3,958 | 108,809 | 14,111 |
| 1989 | 4.82 | 76,626 | 3,831 | 137,704 | 157,630 | - | 146,746 | - | 139,388 | - |
| 1990 | 5.40 | 81,086 | 4,054 | 153,270 | 173,090 | - | 150,700 | 2,570 | 137,692 | 15,578 |
| 1991 | 4.21 | 86,275 | 4,314 | 167,608 | 197,682 | - | 184,313 | - | 174,686 | - |
| 1992 | 3.01 | 90,770 | 4,539 | 180,108 | 218,010 | - | 200,132 | - | 188,103 | - |
| 1993 | 2.99 | 94,410 | 4,721 | 192,627 | 239,438 | - | 219,550 | - | 206,304 | - |
| 1994 | 2.56 | 98,177 | 4,909 | 209,132 | 260,177 | - | 229,500 | - | 211,003 | - |
| 1995 | 2.83 | 101,672 | 5,084 | 228,206 | 295,247 | - | 288,474 | - | 279,650 | - |
| 1996 | 2.95 | 105,566 | 5,278 | 247,702 | 328,295 | - | 337,462 | - | 336,229 | - |

| Year | Annual Returns (%) for Market Indexes | | | Guaranteed Investment Rate [A+1.0%] | Illustrative Investment Return Experience for Alternative Participant Investment Styles | | |
|------|--|-------------------------------|------------------------------------|--|--|--|--|
| | 1-Year | | | | Conservative "15% / 85%" [.15*B+.85*C] | Balanced "60% / 40%" [.6*B+.4*C] | Aggressive "85% / 15%" [.85*B+.15*C] |
| | Treas. Bills Constant Maturities | S&P 500 Stock Composite | S&P Long Term Bond Composite | | | | |
| | | | | | | | |
| 1962 | 3.14 | (11.81) | 4.43 | 4.14 | 1.99 | (5.31) | (9.37) |
| 1963 | 3.44 | 18.89 | 4.35 | 4.44 | 6.53 | 13.07 | 16.71 |
| 1964 | 3.76 | 12.97 | 4.47 | 4.76 | 5.75 | 9.57 | 11.70 |
| 1965 | 4.09 | 9.06 | 4.55 | 5.09 | 5.23 | 7.26 | 8.38 |
| 1966 | 5.11 | (13.09) | 5.22 | 6.11 | 2.47 | (5.77) | (10.34) |
| 1967 | 4.79 | 20.09 | 5.66 | 5.79 | 7.82 | 14.32 | 17.93 |
| 1968 | 5.54 | 7.65 | 6.31 | 6.54 | 6.51 | 7.11 | 7.45 |
| 1969 | 6.86 | (11.35) | 7.16 | 7.86 | 4.38 | (3.95) | (8.57) |
| 1970 | 6.39 | 0.10 | 8.21 | 7.39 | 6.99 | 3.34 | 1.32 |
| 1971 | 4.64 | 10.79 | 7.65 | 5.64 | 8.12 | 9.53 | 10.32 |
| 1972 | 4.82 | 15.63 | 7.51 | 5.82 | 8.73 | 12.38 | 14.41 |
| 1973 | 7.16 | (17.37) | 7.70 | 8.16 | 3.94 | (7.34) | (13.61) |
| 1974 | 7.72 | (29.70) | 8.43 | 8.72 | 2.71 | (14.45) | (23.98) |
| 1975 | 6.37 | 31.51 | 8.91 | 7.37 | 12.30 | 22.47 | 28.12 |
| 1976 | 5.62 | 19.15 | 8.57 | 6.62 | 10.16 | 14.92 | 17.56 |
| 1977 | 5.70 | (11.50) | 8.33 | 6.70 | 5.36 | (3.57) | (8.53) |
| 1978 | 7.68 | 1.06 | 8.93 | 8.68 | 7.75 | 4.21 | 2.24 |
| 1979 | 9.77 | 12.31 | 9.80 | 10.77 | 10.18 | 11.31 | 11.93 |
| 1980 | 10.75 | 25.77 | 12.02 | 11.75 | 14.08 | 20.27 | 23.71 |
| 1981 | 13.16 | (9.77) | 14.32 | 14.16 | 10.71 | (0.13) | (6.16) |
| 1982 | 11.10 | 14.81 | 13.73 | 12.10 | 13.89 | 14.38 | 14.65 |
| 1983 | 8.86 | 17.27 | 11.86 | 9.86 | 12.67 | 15.11 | 16.46 |
| 1984 | 9.91 | 1.40 | 12.94 | 10.91 | 11.21 | 6.02 | 3.13 |
| 1985 | 7.76 | 26.33 | 11.41 | 8.76 | 13.65 | 20.36 | 24.09 |
| 1986 | 6.07 | 14.62 | 9.40 | 7.07 | 10.18 | 12.53 | 13.84 |
| 1987 | 6.33 | 2.03 | 9.66 | 7.33 | 8.52 | 5.08 | 3.17 |
| 1988 | 7.17 | 12.40 | 9.93 | 8.17 | 10.30 | 11.41 | 12.03 |
| 1989 | 7.91 | 27.25 | 9.46 | 8.91 | 12.13 | 20.13 | 24.58 |
| 1990 | 7.36 | (6.56) | 9.67 | 8.36 | 7.24 | (0.07) | (4.13) |
| 1991 | 5.54 | 26.31 | 9.14 | 6.54 | 11.72 | 19.44 | 23.73 |
| 1992 | 3.75 | 4.46 | 8.61 | 4.75 | 7.99 | 6.12 | 5.08 |
| 1993 | 3.33 | 7.06 | 7.77 | 4.33 | 7.66 | 7.34 | 7.17 |
| 1994 | 5.02 | (1.54) | 8.05 | 6.02 | 6.61 | 2.30 | (0.10) |
| 1995 | 5.69 | 34.11 | 7.54 | 6.69 | 11.53 | 23.48 | 30.12 |
| 1996 | 5.23 | 20.26 | 7.49 | 6.23 | 9.41 | 15.15 | 18.34 |

Table 4
Comparison of Cash Balance Floor Plan's Lump Sum Basis with
Current Liability Bases
for a GIDC Plan with True DC Plan Operational Appeal

| Assumption | CB floor plan lump sum basis | Current liability basis | | |
|--------------------------|--|--|--|----------------------------|
| | | OBRA87 | RPA94 | PBGC |
| Preretirement interest | Last known (safe harbor) crediting interest rate | 90–110% of 4yr average of 30yr Treasury yields | 90–105% of 4yr average of 30yr Treasury yields | 85% of 30yr Treasury yield |
| Preretirement mortality | None | Funding assumption | 83GAM | 83GAM |
| Postretirement Interest | Plan's 417(e)(3) rate | Same as preretirement | Same as preretirement | Same as preretirement |
| Postretirement mortality | U83GAM | Same as preretirement | Same as preretirement | Same as preretirement |

Table 5
Illustration of the Self-Immunitization Property of Cash Balance Floor Plan
Current Liability for an Assumed Lump Sum Distribution

| 30-year Treasury constant maturities yield | Traditional current liability change (w/duration=10 years) | Changes in cash balance floor plan current liability to baseline assumption | | |
|--|--|---|--------------|--------------|
| | | OBRA87 | RPA94 | PBGC |
| 5.0% | 110.0% | 100.6% | 99.2% | 95.1% |
| 5.5 | 105.0 | 100.3 | 99.6 | 97.6 |
| 6.0 baseline | 100.0 | 100.0 | 100.0 | 100.0 |
| 6.5 | 95.0 | 99.7 | 100.4 | 102.4 |
| 7.0 | 90.0 | 99.4 | 100.7 | 104.9 |

Table 6
Illustration of the Self-Immunitization Property of Cash Balance Floor Plan
Current Liability for an Assumed Annuity Distribution

| 30-year Treasury constant maturities yield | Traditional current liability change (w/duration=15 years) | Changes in cash balance floor plan current liability to baseline assumption | | |
|--|--|---|--------------|--------------|
| | | OBRA87 | RPA94 | PBGC |
| 5.0% | 115.0% | 100.2% | 99.3% | 96.4% |
| 5.5 | 107.5 | 100.1 | 99.6 | 98.2 |
| 6.0 baseline | 100.0 | 100.0 | 100.0 | 100.0 |
| 6.5 | 92.5 | 99.9 | 100.3 | 101.8 |
| 7.0 | 85.0 | 99.8 | 100.7 | 103.5 |

Table 7

Calculated Values of $\frac{s \ddot{a}_{NRA}^{(12)}}{p \ddot{a}_{NRA}^{(12)}} * \frac{s \ell_{NRA}}{s \ell_{AA}}$

| AA | $pj = 5\%$ | | $pj = 6\%$ | | $pj = 8\%$ | |
|----|------------|--------|------------|--------|------------|--------|
| | UP84 | U83GAM | UP84 | U83GAM | UP84 | U83GAM |
| 31 | 0.848 | 0.830 | 0.911 | 0.899 | 1.039 | 1.041 |
| 32 | 0.849 | 0.830 | 0.912 | 0.899 | 1.040 | 1.041 |
| 33 | 0.850 | 0.831 | 0.913 | 0.900 | 1.041 | 1.042 |
| 34 | 0.851 | 0.831 | 0.914 | 0.900 | 1.043 | 1.042 |
| 35 | 0.853 | 0.832 | 0.916 | 0.901 | 1.044 | 1.043 |
| 36 | 0.854 | 0.832 | 0.917 | 0.902 | 1.046 | 1.044 |
| 37 | 0.855 | 0.833 | 0.918 | 0.902 | 1.047 | 1.045 |
| 38 | 0.856 | 0.833 | 0.920 | 0.903 | 1.049 | 1.045 |
| 39 | 0.858 | 0.834 | 0.921 | 0.904 | 1.051 | 1.046 |
| 40 | 0.860 | 0.835 | 0.923 | 0.904 | 1.053 | 1.047 |
| 41 | 0.862 | 0.836 | 0.925 | 0.905 | 1.055 | 1.048 |
| 42 | 0.864 | 0.836 | 0.927 | 0.906 | 1.057 | 1.049 |
| 43 | 0.866 | 0.837 | 0.930 | 0.907 | 1.060 | 1.050 |
| 44 | 0.868 | 0.839 | 0.932 | 0.908 | 1.063 | 1.052 |
| 45 | 0.871 | 0.840 | 0.935 | 0.910 | 1.066 | 1.053 |
| 46 | 0.874 | 0.841 | 0.939 | 0.911 | 1.070 | 1.055 |
| 47 | 0.877 | 0.843 | 0.942 | 0.913 | 1.074 | 1.057 |
| 48 | 0.881 | 0.844 | 0.946 | 0.915 | 1.079 | 1.059 |
| 49 | 0.885 | 0.846 | 0.950 | 0.917 | 1.084 | 1.061 |
| 50 | 0.890 | 0.848 | 0.955 | 0.919 | 1.089 | 1.064 |
| 51 | 0.895 | 0.851 | 0.961 | 0.922 | 1.095 | 1.067 |
| 52 | 0.900 | 0.853 | 0.967 | 0.924 | 1.102 | 1.070 |
| 53 | 0.906 | 0.856 | 0.973 | 0.928 | 1.110 | 1.074 |
| 54 | 0.913 | 0.859 | 0.981 | 0.931 | 1.118 | 1.078 |
| 55 | 0.921 | 0.863 | 0.989 | 0.935 | 1.128 | 1.082 |
| 56 | 0.929 | 0.866 | 0.998 | 0.939 | 1.138 | 1.087 |
| 57 | 0.938 | 0.871 | 1.008 | 0.943 | 1.149 | 1.092 |
| 58 | 0.949 | 0.875 | 1.019 | 0.948 | 1.162 | 1.098 |
| 59 | 0.960 | 0.880 | 1.031 | 0.953 | 1.176 | 1.104 |
| 60 | 0.973 | 0.885 | 1.045 | 0.959 | 1.191 | 1.110 |
| 61 | 0.987 | 0.891 | 1.060 | 0.966 | 1.208 | 1.118 |
| 62 | 1.002 | 0.898 | 1.076 | 0.973 | 1.227 | 1.126 |
| 63 | 1.020 | 0.905 | 1.095 | 0.981 | 1.249 | 1.136 |
| 64 | 1.039 | 0.914 | 1.116 | 0.990 | 1.272 | 1.146 |
| 65 | 1.061 | 0.923 | 1.139 | 1.000 | 1.299 | 1.158 |