

## **Appendix 2 to the Board's determination under Section 175(5) of the Pensions Act 2004 in respect of the financial year 1 April 2007 – 31 March 2008**

### **Methodology for adapting MFR valuations to estimate liabilities on a section 179 basis for the purpose of calculating the pension protection levy in respect of the financial year 1 April 2007 – 31 March 2008**

#### **Summary**

This document details the formulae developed jointly by the Board of the Pension Protection Fund and the Government Actuary's Department to adapt valuation results which have been provided to the Board on a Minimum Funding Requirement (MFR) basis (in the Scheme Return) into valuation results on a section 179 basis as at 31 October 2006 (referred to as "the output date" below).

This document complements the document published on 1 March 2007 setting out the formulae for transforming section 179 valuation results at dates other than the output date into results at that date.

#### **1 Background**

- 1.1 A scheme's funding information on an MFR basis will be contained within the Scheme Return issued by the Pensions Regulator.
- 1.2 For the 2007/08 levy year, a scheme also has the option of undertaking a valuation on a Pension Protection Fund liabilities (section 179) basis and providing this information to the Board by 31 March 2007.
- 1.3 MFR valuations are calculated using a prescribed methodology and set of assumptions which will give a very different result to a calculation using section 179 assumptions. The Board wishes to undertake the risk based levy calculations using underfunding risk on a consistent (section 179) basis for all schemes. In order to do so for the 2007/08 levy year the Board of the Pension Protection Fund, in consultation with the Government Actuary's Department, created a model for converting the information contained within MFR valuations into valuations on a section 179 basis. This will enable the Board to roll forward all MFR and section 179 valuations to a consistent valuation date, 31 October 2006..
- 1.4 The model itself only uses information about each scheme that can be obtained from the Scheme Return issued by the Pensions Regulator, together with published data on investment market conditions.

## 2 Summary of the calculation

2.1 The formulae constitute a technical actuarial document which is intended to be read only by those with significant experience in carrying out MFR and other actuarial calculations. For those with a broad interest in the conversion proposal, the main stages of the calculations are summarized below.

2.2 Transformation of liabilities from the MFR basis to the section 179 basis.

- The MFR methodology prescribes an allowance for expenses and removing this allowance is the first stage in transforming the liabilities.
- The MFR methodology also prescribes adjustments to non-pensioner liabilities related to stock market conditions at the MFR calculation date, which are also removed.
- The formulae then make assumptions about the proportion of liabilities that relate to service before and after 6 April 1997, to allow for differences in Pension Protection Fund compensation for service before and after 1997.
- Ratios of annuity factors and deferred annuity factors are then used to convert the stripped down MFR liabilities to section 179 assumptions. This is a typical actuarial method for adjusting for changes in pension increase assumptions.
- The liabilities are at this point still effective at the MFR calculation date, despite being calculated with reference to section 179 assumptions at the output date, and still reflect the scheme's benefit structure.

2.3 Moving assets and the liabilities forward from the date of the MFR calculation to the output date.

- Liabilities are increased at a rate that is reasonably consistent with section 179 assumptions, as the liabilities are now closer to coming into payment.
- The assets are assumed to achieve returns in line with certain stock market indices, allowance being made for how much of the scheme's assets are invested in equities, bonds etc. as taken from the Scheme Return provided to the Pensions Regulator.
- The liabilities are now at the output date, and are based on section 179 assumptions. However, they still reflect scheme benefits.
- Neither assets nor liabilities are adjusted for benefit payments. Liabilities are not adjusted for new benefit accrual, nor are assets adjusted for contributions. Where these assumptions are reckoned likely to lead to a significantly inaccurate result for a scheme, an up-to-date section 179 valuation (possibly approximate) should be considered. Alternatively certification of special contributions should be considered.

## 2.4 Allowing for Pension Protection Fund benefit levels in the rolled forward liabilities.

- Ratios of annuities are used to reduce the liabilities to reflect PPF benefit levels for pensioners.
- A reduction is then made in the expectation that some of the pensioner membership will be below normal pension age, where their benefits would be subject to the cap on compensation and reduced to a 90% compensation level.
- Similar reductions are then applied to non-pensioner liabilities. An assumption is made that a proportion of non-pensioner liabilities would be restricted by the compensation cap and all non-pensioner liabilities would be reduced to a 90% compensation level.
- As a final step the expenses specified for Section 179 calculations are added to the liabilities to give the final results.

## 3 Summary of outputs from and inputs to the formulae

### 3.1 Outputs

• Assets for section 179 valuation	S179Ass
• Liabilities for pensions in payment (excluding section 179 member-related expenses)	S179PL
• Liabilities for deferred members (excluding section 179 member-related expenses)	S179DL
• Liabilities for active members (excluding section 179 member-related expenses)	S179AL
• S179 estimated cost of wind-up (excluding benefit installation/payment)	S179WUExp
• S179 estimated expenses of benefit installation/payment	S179PayExp
• Effective date of the section 179 valuation required for output (31 October 2006)	OutputDate

From these can be calculated

• Total liabilities (including section 179 expense allowance)	S179TL
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### 3.2 Inputs

The latest MFR valuation results as given on the Scheme Return issued by the Pensions Regulator (section 18.2):

• Assets for MFR valuation purposes	MFRAss
• Total liabilities (including MFR expense allowance)	MFRTL
• Liabilities for pensions in payment (possibly including the MFR expense allowance)	MFRPL
• Liabilities for deferred members (possibly including the MFR expense allowance)	MFRDL
• Liabilities for active members (possibly including the MFR expense allowance)	MFRAL
• MFR expense allowance (if not included in separate liability figures for pensioners, deferreds, actives)	MFRExp
• MFR funding level (assets as a percentage of total liabilities)	MFR%
• Effective date of the MFR valuation	MFRDate

Information on scheme pension indexation policy (section 23.1)

• Information about the indexation of scheme benefits accruing pre1997 (fixed increases/percentage of RPI/full RPI/capped RPI/RPI with maximum and minimum/none)	IndMeth
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Scheme asset information in the scheme return (section 24.1) – percentages of the total assets as at the date of the last audited financial statement (note that this is the same as or after MFRDate identified above; the value of assets at AssetDate is not known, and it may be rather different from MFRAss where, for instance, a bulk transfer has taken place):

• Insurance policies (excluding managed funds)	IP%
• Equities	Eq%
• Gilts/fixed interest products	FI%
• Property	Pr%
• Cash and deposits	Ca%
• Others	Ot%
• Date of asset breakdown	AssetDate

Numbers of members with defined benefits only or partial defined benefits from the Scheme Return (section 7.1)

• Pensioner members	PMemNo
• Deferred members	DMemNo
• Active members	AMemNo

Average ages of different classes of members from the Scheme Return (section 7.3)

• Pensioner members	PAvAge
• Deferred members	DAvAge
• Active members	AAvAge

Where any of the above information has not been provided, the Board of the Pension Protection Fund will need to adopt an assumed value. Details of the assumptions that will be made in these circumstances are set out at the end of this document. Note also that average ages falling outside particular ranges will be subject to adjustment (see end of document for details).

## 4 The formulae

### a) Transformation of liabilities from the MFR basis to the section 179 basis

#### l) Strip out any expense allowance from liability figures if necessary

$$\text{MFRPLNoExp} = \text{MFRPL} / (1 + \text{MFRExp}\%)$$

$$\text{MFRDLNoExp} = \text{MFRDL} / (1 + \text{MFRExp}\%)$$

$$\text{MFRALNoExp} = \text{MFRAL} / (1 + \text{MFRExp}\%)$$

Where  $(1 + \text{MFRExp}\%) = 100\%$  if  $\text{MFRExp} > 0$ , or

$$= 104\% \text{ if } \text{MFRTL} < \text{£}52 \text{ million,}$$

$$= (1.03 \times \text{MFRTL}) / (\text{MFRTL} - \text{£}0.5 \text{ million})$$

if  $\text{£}52 \text{ million} \leq \text{MFRTL} < \text{£}103.5 \text{ million,}$

$$= (1.02 \times \text{MFRTL}) / (\text{MFRTL} - \text{£1.5 million})$$

if MFRTL >= £103.5 million

## II) Strip out market value adjustments in non-pensioner liabilities

MFRDLNoExpNoMVA@MFRDate

$$= (\text{MFRDLNoExp@MFRDate}) / (\text{MFRNPMVA@MFRDate})$$

MFRALNoExpNoMVA@MFRDate

$$= (\text{MFRALNoExp@MFRDate}) / (\text{MFRNPMVA@MFRDate})$$

Where MFRNPMVA@MFRDate

$$= ((1 - K) \times \text{MFREqMVA@MFRdate}) + K \times \text{MFRgiltMVA@MFRDate}$$

$$K = \frac{\text{MFRPLNoExp}}{(\text{MFRPLNoExp} + \text{MFRDLNoExp} + \text{MFRALNoExp})}$$

( $0 \leq K \leq 1$ , see footnote<sup>1</sup>)

MFREqMVA@MFRdate and MFRgiltMVA@MFRdate calculated from financial market data as at MFRDate. If IndMeth = "fixed" or "none", then use the conventional gilt MVA, otherwise use the index-linked gilt MVA. No allowance is made for the possibility that a scheme had been using a gilts-matching policy.

## III) Strip out the adjustment factor for non-pensioners which allows for the MFR assumed switch from equity to gilt investment in the 10 years to retirement

MFRDLBasic@MFRdate

$$= (\text{MFRDLNoExpNoMVA@MFRdate}) / (1 + n \times 0.005)$$

MFRALBasic@MFRdate

$$= (\text{MFRALNoExpNoMVA@MFRdate}) / (1 + n \times 0.005)$$

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<sup>1</sup> K represents, broadly, the proportion of non-pensioner liabilities in the original MFR valuation which would have been adjusted by the gilt MVA rather than the equity MVA. It is to some extent a measure of the maturity of the scheme. The proportion of total scheme liabilities that relate to pensioners is in general another measure of the maturity of the scheme, so a proportion based on this is used.

$$n = 10 \times (1 - K)$$

(Same rationale as for K, but different sign, and range 0 to 10.)

#### IV) Allowance for equity easement in calculation of pensioner liabilities

MFRPLEqEase

$$= 0.2 \times \frac{\text{MFRPLNoExp}}{\text{MFREqMVA@MFRdate}} \quad \text{if MFRPLNoExp} \geq \text{£100 million}$$

$$= 0 \quad \text{otherwise}$$

MFRPLGilt

$$= \text{MFRPLNoExp} - (\text{MFRPLEqEase} \times \text{MFREqMVA@MFRdate})$$

$$M = \frac{\max [ 0, \min ( \text{£125 million}, \text{MFRPLNoExp} ) - \text{£100 million} ]}{\text{£25 million}}$$

( $0 \leq M \leq 1$ , see footnote<sup>2</sup>)

M is therefore zero if MFRPLNoExp is less than £100 million. M is 1 if MFRPLNoExp is more than £125 million. M increases linearly from 0 to 1 as MFRPLNoExp increase from £100 million to £125 million.

Clearly, for the majority of schemes MFRPLEqEase = 0, that is, the scheme was probably not big enough to use the equity easement in the calculation of its pensioner liabilities for MFR purposes. In these cases MFRPLEqEase and MFRPLGilt are not used in the calculation.

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<sup>2</sup> The formulae in the following sections apply different adjustments to pensioner liabilities depending upon whether the equity easement would have been used or not. It is desirable to avoid a disproportionate change in the calculation results between a scheme with, say, £99 million of MFRPLNoExp pensioner liabilities and an otherwise identical scheme with £101 million of pensioner liabilities where the equity easement will have had limited impact. To achieve this, “equity easement formulae” will be applied in full to schemes with over £125 million of pensioner liabilities. “No equity easement formulae” will be applied in full to schemes with less than £100 million of pensioner liabilities. A combination of the results from these two sets of formulae will be applied to schemes with between £100 million and £125 million of pensioner liabilities. The contribution each set of formulae make to the calculation will be determined using factor M.

**V) Divide the liabilities between those accrued before and after April 1997 (different indexation)<sup>3</sup>**

$$\text{MFRPLPre97@MFRdate} = \text{MFRPLNoExp@MFRdate} \times 0.9$$

$$\text{MFRPLPost97@MFRdate} = \text{MFRPLNoExp@MFRdate} \times 0.1$$

(N.B. The above two items need not be calculated when  $\text{MFRPLNoExp} \geq \text{£}125$  million, i.e. when  $M = 1$ .)

$$\begin{aligned} \text{MFRPLEqEasePre97@MFRdate} \\ = \text{MFRPLEqEase@MFRdate} \times 0.85 \end{aligned}$$

$$\begin{aligned} \text{MFRPLEqEasePost97@MFRdate} \\ = \text{MFRPLEqEase@MFRdate} \times 0.15 \end{aligned}$$

$$\begin{aligned} \text{MFRPLGiltPre97@MFRdate} \\ = \text{MFRPLGilt@MFRdate} \times 0.91 \end{aligned}$$

$$\begin{aligned} \text{MFRPLGiltPost97@MFRdate} \\ = \text{MFRPLGilt@MFRdate} \times 0.09 \end{aligned}$$

(N.B. The above four quantities need not be calculated when  $\text{MFRPLNoExp} \leq \text{£}100$  million, i.e. when  $M = 0$ .)

$$\begin{aligned} \text{MFRDLPre97@MFRdate} \\ = \text{MFRDLBasic@MFRdate} \times 0.8 \end{aligned}$$

$$\begin{aligned} \text{MFRDLPost97@MFRdate} \\ = \text{MFRDLBasic@MFRdate} \times 0.2 \end{aligned}$$

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<sup>3</sup> These average values for the proportions of pensioner, deferred pensioner and active liabilities that relate to service before April 1997 are estimates which are assumed to apply to the aggregate of all schemes.

$$\begin{aligned} & \text{MFRALPre97@MFRdate} \\ & = \text{MFRALBasic@MFRdate} \times 0.6 \end{aligned}$$

$$\begin{aligned} & \text{MFRALPost97@MFRdate} \\ & = \text{MFRALBasic@MFRdate} \times 0.4 \end{aligned}$$

**VI) Convert from MFR economic assumptions at MFRDate to section 179 basis (all benefits, not just PPF protected benefits) as at OutputDate<sup>4</sup>**

**Pensioner liabilities**

$$\begin{aligned} & \text{S179FullPLPre97NoEase@MFRdate} \\ & = \text{MFRPLPre97@MFRdate} \times \frac{\text{AnnuityFactor}(\text{S179rate@OutputDate})}{\text{AnnuityFactor}(\text{MFRrate@MFRDate})} \end{aligned}$$

For pre 1997 liabilities S179rate@OutputDate and MFRrate@MFRDate vary according to the scheme pension increases (indicated by IndMeth) and economic conditions on MFRDate and OutputDate.

Interest rate assumptions for annuity factor on MFR basis

- Following guidance for MFR valuations in GN27 Appendix 2, paragraph A<sup>5</sup>.

Assumptions for AnnuityFactor(S179rate@OutputDate) should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

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<sup>4</sup> Note that factors based on section 179 economic assumptions but full scheme benefits cancel out with those used in stage (c), so that assumptions here are not critical to the final results.

<sup>5</sup> For a complete list of the adjustments to be made here and elsewhere, see the appendix to this note.

For post 1997 liabilities, assume that indexation is at statutory minimum requirements, that is, in line with RPI with a 5% a year cap.

$S179FullPLPost97NoEase@MFRdate$

$$= MFRPLPost97@MFRdate \times \frac{AnnuityFactor(S179rate@OutputDate)}{AnnuityFactor(MFRrate@MFRDate)}$$

Interest rate assumptions for annuity factor on MFR basis

- Following guidance for MFR valuations in GN27 Appendix 2, paragraph A.

Other assumptions for annuity factors on MFR basis

- Mortality for annuity factor: PA90 – 2. No scheme specific mortality.

Assumptions for  $AnnuityFactor(S179rate@OutputDate)$  should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

General assumptions for annuity factors

- Age: PAvAge
- Sex: male
- Spouse's proportion: 0.5
- Proportion married: 80%
- Wife three years younger than member

$S179PLEqEasePre97@MFRdate$

$$= MFRPLEqEasePre97@MFRdate \times \frac{DefAnnuityFactor(S179rate@OutputDate)}{DefAnnuityFactor(MFRrate@MFRDate)}$$

For pre 1997 liabilities  $S179rate@OutputDate$  and  $MFRrate@MFRDate$  vary according to the scheme pension increases (indicated by IndMeth) and economic conditions on MFRDate and OutputDate.

Interest rate assumptions for deferred annuity factor on MFR basis

- Following guidance for MFR valuations in GN27 Appendix 2, paragraph A<sup>5</sup>.

Assumptions for DefAnnuityFactor(S179rate@OutputDate) should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

For post 1997 liabilities, assume that indexation is at statutory minimum requirements, that is, in line with RPI with a 5% a year cap.

S179PLEqEasePost97@MFRdate

$$= \text{MFRPLEqEasePost97@MFRdate} \times \frac{\text{DefAnnuityFactor(S179rate@OutputDate)}}{\text{DefAnnuityFactor(MFRrate@MFRDate)}}$$

Interest rate assumptions for deferred annuity factor on MFR basis

- Following guidance for MFR valuations in GN27 Appendix 2, paragraph A<sup>5</sup>.

Assumptions for DefAnnuityFactor(S179rate@OutputDate) should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

Other assumptions for deferred annuity factors

- 12 year deferment period, 4 year payment period (fixed, no allowance for mortality) for MFR basis.
- 12 year deferment period, 8.5 year payment period (fixed, no allowance for mortality) for section 179 basis.

S179PLGiltPre97@MFRdate

$$= \text{MFRPLGiltPre97@MFRdate} \times \frac{\text{AnnuityFactor(S179rate@OutputDate)}}{\text{AnnuityFactor(MFRrate@MFRDate)}}$$

S179PLGiltPost97@MFRdate

$$= \text{MFRPLGiltPost97@MFRdate} \times \frac{\text{AnnuityFactor(S179rate@OutputDate)}}{\text{AnnuityFactor(MFRrate@MFRDate)}}$$

Same points as above about indexation allowance for pre and post 1997 rights.

Interest rate assumptions for annuity factor on MFR basis

- Following guidance for MFR valuations in GN27 Appendix 2, paragraph A<sup>5</sup>.

Assumptions for DefAnnuityFactor(S179rate@OutputDate) should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

Other assumptions for annuity factors

- Fixed term (no allowance for mortality) of 10 years for MFR basis
- Fixed term (no allowance for mortality) of 11 years for section 179 basis

(Recognises that these annuities represent a mixture of liabilities limited by mortality of scheme members and the 12 year limit for dividing pensioner liabilities for the purposes of the equity easement.)

S179FullPLPre97EqEase@MFRdate

$$= \text{S179PLEqEasePre97@MFRdate} + \text{S179PLGiltPre97@MFRdate}$$

S179FullPLPost97EqEase@MFRdate

$$= \text{S179PLEqEasePost97@MFRdate} + \text{S179PLGiltPost97@MFRdate}$$

S179FullPLPre97@MFRdate

$$= (1 - M) \times \text{S179FullPLPre97NoEase@MFRdate} + \\ M \times \text{S179FullPLPre97EqEase@MFRdate}$$

S179FullPLPost97@MFRdate

$$= (1 - M) \times \text{S179FullPLPost97NoEase@MFRdate} + \\ M \times \text{S179FullPLPost97EqEase@MFRdate}$$

For schemes with  $MFRPLEqEase \leq \text{£}100$  million,  $S179FullPL * 97EqEase$  may not have been calculated since  $M=0$ . Similarly  $S179FullPL * 97NoEase$  may not have been calculated for schemes with  $MFRPLEqEase \geq \text{£}125$  million since  $M=1$ .

Calculations for schemes where  $MFRPLEqEase > 0$  are the same as for other schemes hereafter.

### Non-pensioner liabilities

$S179FullIDLPre97@MFRdate$

$$= \frac{MFRDLPre97@MFRdate \times \text{DefAnnuityFactor}(S179rate@OutputDate)}{MFRDefAnnuityFactor}$$

$S179FullIALPre97@MFRdate$

$$= \frac{MFRALPre97@MFRdate \times \text{DefAnnuityFactor}(S179rate@OutputDate)}{MFRDefAnnuityFactor}$$

Post-retirement discount rates – depend on IndMeth:

Post-retirement interest rate assumption for deferred annuity factor on MFR basis:

$$1.08/(1+p) - 100\%, \quad p \text{ based on IndMeth (GN27 Appendix 2, paragraph B1)}^5$$

Assumptions for  $\text{DefAnnuityFactor}(S179rate@OutputDate)$  should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

For post 1997 liabilities, assume that scheme indexation is at statutory minimum requirements, that is, in line with RPI with a 5% a year cap.

S179FullIDLPost97@MFRdate

$$= \text{MFRDLPost97@MFRdate} \times \frac{\text{DefAnnuityFactor(S179rate@OutputDate)}}{\text{MFRDefAnnuityFactor}}$$

S179FullIALPost97@MFRdate

$$= \text{MFRALPost97@MFRdate} \times \frac{\text{DefAnnuityFactor(S179rate@OutputDate)}}{\text{MFRDefAnnuityFactor}}$$

Interest rate assumption for deferred annuity factor on MFR basis:

- 1.08/1.035 – 100% (GN27 Appendix 2, paragraph B1)<sup>5</sup>

Assumptions for DefAnnuityFactor(S179rate@OutputDate) should be consistent with version A3 of the section 179 assumptions guidance. See the table in the final section of this document setting out the derivation of discount rates for different pension increases.

Generally  $\text{DefAnnuityFactor}() = (1 / (1 + i)^t) \times \text{AnnuityFactor}()$  and similarly for MFRDefAnnuityFactor, as no allowance for mortality before retirement.

t = period to retirement,

taken as (normal pension age – AAvAge/DAvAge (as appropriate)<sup>6</sup>).

Other assumptions for MFRDefAnnuityFactor

- Discount rate pre-retirement: 9% a year
- Deferred pension increases: 4.5% a year<sup>7</sup>
- Bringing these together gives  $i = (1.09/1.045) - 100\%$
- Mortality for annuity factor: PA90 – 2

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<sup>6</sup> Details of the assumption to be adopted where average ages have not been provided are included at the end of this document.

<sup>7</sup> A very crude average of Guaranteed Minimum Pension (> 4% a year) and statutorily revalued excess-over-GMP (4% a year in the MFR basis) and excess-over-GMP that is not statutorily revalued (0% a year).

Pre-retirement net discount rate for DefAnnuityFactor(S179rate@OutputDate)

- Average of FTSE Actuaries Government Securities Index-Linked annualised real yields >15 years assuming 0% and 5% inflation as at InputDate – 0.7%

General assumptions for annuity/deferred annuity factors

- Normal pension age: 63
- Age: AAvAge/DAvAge (as appropriate)<sup>6</sup>
- Sex: male
- Spouse's proportion: 0.5
- Proportion married at retirement: 80%
- Wife three years younger than member
- No allowance for pre-retirement mortality
- Where AAvAge or DAvAge > 63, an immediate annuity is used in place of a deferred annuity

## **b) Moving assets and the liabilities forward from MFRDate to OutputDate**

### **l) Liabilities**

S179FullPLPre97@OutputDate

$$= S179FullPLPre97@MFRdate \times (1 + i)^{(OutputDate - MFRDate)}$$

S179FullDLPre97@OutputDate

$$= S179FullDLPre97@MFRdate \times (1 + i)^{(OutputDate - MFRDate)}$$

S179FullALPre97@OutputDate

$$= S179FullALpre97@MFRdate \times (1 + i)^{(OutputDate - MFRDate)}$$

Time periods (OutputDate – MFRDate) measured in years and fractions of years.

And similarly for post 1997 liabilities

i = annualised yield on the FTSE Actuaries Government 15-Year Fixed Interest index as at OutputDate

## II) Assets

Reflect returns likely to have been earned on schemes' actual assets using, as far as possible, published information about returns on assets in different classes.

If AssetDate = MFRDate,

$$\text{Equities@MFRDate} = \text{MFRAss} \times \text{Eq\%}$$

$$\text{FI@MFRDate} = \text{MFRAss} \times \text{FI\%}$$

$$\text{Prop@MFRDate} = \text{MFRAss} \times \text{Pr\%}$$

$$\text{Cash@MFRDate} = \text{MFRAss} \times \text{Ca\%}$$

$$\text{Insurance@MFRDate} = \text{MFRAss} \times \text{IP\%}$$

$$\text{Other@MFRDate} = \text{MFRAss} \times \text{Ot\%}$$

Then,

$$\text{Equities@OutputDate} = \text{Equities@MFRDate} \times \text{EqRet}(\text{MFRdate}, \text{Outputdate})$$

Where  $\text{EqRet}(\text{MFRdate}, \text{Outputdate})$

$$= 55\% \times \left( \frac{\text{FTSE-Allshare TRI@OutputDate}}{\text{FTSE-Allshare TRI@MFRDate}} \right)$$

$$+ 45\% \times \left( \frac{\text{MSCI World (gross) Total Return Index@OutputDate}}{\text{MSCI World (gross) Total Return Index@MFRDate}} \right)^8$$

$$\text{FI@OutputDate} = \text{FI@MFRDate} \times \frac{\text{FTSE-UK gilt TRI@OutputDate}}{\text{FTSE-UK gilt TRI@MFRDate}}$$

$$\text{Prop@OutputDate} = \text{Prop@MFRDate} \times \text{EqRet}(\text{MFRdate}, \text{Outputdate})$$

$$\text{Cash@OutputDate} = \text{Cash@MFRDate} \times (1 + \text{Cashreturn\%}(\text{MFRDate}, \text{OutputDate}))$$

Cashreturn% estimated by rolling up Bank of England base rate from MFRDate to OutputDate

$$\text{Insurance@OutputDate} = \text{Insurance@MFRDate} \times \text{CompRet}(\text{MFRdate}, \text{Outputdate})$$

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<sup>8</sup> MSCI index expressed in £ sterling terms

Where

CompRet(MFRdate, Outputdate) = Composite roll-up factor created based on 50% of the fixed interest roll-up factor above, 25% of the equity roll-up factor and 25% of the cash roll-up factor

$$\text{Other@OutputDate} = \text{Other@MFRDate} \times \text{CompRet}(\text{MFRdate}, \text{Outputdate})$$
$$\begin{aligned} \text{S179Ass} &= \text{S179Ass@OutputDate} \\ &= \text{Equities@OutputDate} + \text{FI@OutputDate} + \text{Prop@OutputDate} \\ &\quad + \text{Cash@OutputDate} + \text{Insurance@OutputDate} \\ &\quad + \text{Other@OutputDate} \end{aligned}$$

If AssetDate is later than MFRDate,

Derive the asset distribution at MFRDate which produces the given asset distribution at AssetDate, allowing for differential asset returns based on information on returns on different investments. In effect the formulae above are used “in reverse” for the period from AssetDate back to MFRDate and applied to the proportions of assets in each class as at AssetDate. The asset distribution at MFRDate is thereby calculated by normalising the total to 100%.

### **c) Allowing for PPF benefit levels in the liabilities at output date**

#### **l) Conversion to protected liabilities**

##### **Pensioner liabilities**

Different indexation in the PPF compared to the scheme rules (as reflected in the MFR valuation, carried through to S179Full\*L variables calculated above).

S179PPFIndexPLPre97

$$= \text{S179FullPLPre97@Outputdate} \times \frac{\text{AnnuityFactor1}(\text{S179rate@OutputDate})}{\text{AnnuityFactor2}(\text{S179rate@OutputDate})}$$

AnnuityFactor1 (with PPF indexation, none for pre 1997 benefits) is based on the discount rate set out in Version A3 of the s179 guidance on assumptions (the version in force at OutputDate).

Note that AnnuityFactor2 is the same as AnnuityFactor(S179rate@OutputDate) at stage (a)(VI), and it is therefore not critical to the eventual result.

S179PPFIndexPLPost97

$$= S179FullPLPost97@Outputdate \times \frac{\text{AnnuityFactor3}(S179rate@OutputDate)}{\text{AnnuityFactor4}(S179rate@OutputDate)}$$

Annuityfactor3 is based on the discount rate set out in Version A3 of the s179 guidance on assumptions (the version in force at OutputDate).

Note that AnnuityFactor4 is the same as AnnuityFactor(S179rate@OutputDate) at stage (a)(VI), and it is therefore not critical to the eventual result.

Other assumptions for annuity factors (as in step (a)(VI))

- Mortality for annuity factor: PMA92mc (U=OutputDate)
- Age: PAvAge
- Sex: male
- Spouse's proportion: 0.5
- Proportion married: 80%
- Wife three years younger than member

Cut-backs to 90% and the cap for those under scheme normal pension age. These will affect only a small proportion of cases. Use a simple proportion, constant for all schemes of 97%.

$$S179PL = 0.97 \times (S179PPFIndexPLPre97 + S179PPFIndexPLPost97)$$

## **Non-pensioners**

### **Different indexation in payment and revaluation in deferment**

S179PPFIndexDLPre97

$$= S179FullDLPre97@OutputDate \times \frac{\text{DefAnnuityFactor1}(S179rate@OutputDate)}{\text{DefAnnuityFactor2}(S179rate@OutputDate)}$$

### S179PPFIndexALPre97

$$= S179FullALPre97@OutputDate \times \frac{\text{DefAnnuityFactor3}(S179rate@OutputDate)}{\text{DefAnnuityFactor4}(S179rate@OutputDate)}$$

Pre- and post-retirement discount rates for DefAnnuityFactor1 and DefAnnuityFactor3 are based on the discount rate set out in Version A3 of the s179 guidance on assumptions (the version in force at OutputDate).

Assumptions in DefAnnuityFactor2 and DefAnnuityFactor4 match those in deferred annuity factors in stage (a)(VI), and therefore are not critical to the eventual result.

### Other assumptions for deferred annuity factors

- Mortality for annuity factor: PMA92mc (U=OutputDate + 63 – AAvAge/DAvAge (as appropriate))
- Normal pension age: 63
- Age: AAvAge/DAvAge (as appropriate)
- Sex: male
- Spouse's proportion: 0.5
- Proportion married at retirement: 80%
- Wife three years younger than member
- No allowance for pre-retirement mortality
- Where AAvAge or DAvAge > 63, an immediate annuity is used in place of a deferred annuity

### S179PPFIndexDLPost97

$$= S179FullDLPost97@OutputDate \times \frac{\text{DefAnnuityFactor5}(S179rate@OutputDate)}{\text{DefAnnuityFactor6}(S179rate@OutputDate)}$$

### S179PPFIndexALPost97

$$= S179FullALPost97@OutputDate \times \frac{\text{DefAnnuityFactor7}(S179rate@OutputDate)}{\text{DefAnnuityFactor8}(S179rate@OutputDate)}$$

Pre- and post-retirement discount rates for DefAnnuityFactor5 and DefAnnuityFactor7 are based on the discount rate set out in Version A3 of the s179 guidance on assumptions (the version in force at OutputDate).

Assumptions in DefAnnuityFactor6 and DefAnnuityFactor8 match those in deferred annuity factors in stage (a)(VI), and therefore are not critical to the eventual result.

Other assumptions for deferred annuity factors

- Mortality for annuity factor: PMA92mc (U= OutputDate + 63 – AAvAge/DAvAge (as appropriate))
- Normal pension age: 63
- Age: AAvAge/DAvAge (as appropriate)
- Sex: male
- Spouse's proportion: 0.5
- Proportion married at retirement: 80%
- Wife three years younger than member
- No allowance for pre-retirement mortality
- Where AAvAge or DAvAge > 63, an immediate annuity is used in place of a deferred annuity

### **Cap**

S179CutbackDL

$$= (S179PPFIndexDLPre97 + S179PPFIndexDLPost97) \times CapD$$

S179CutbackAL

$$= (S179PPFIndexALPre97 + S179PPFIndexALPost97) \times CapA$$

$$CapD = CapA = 0.98$$

### **Application of the 90% factor**

$$S179DL = 0.90 \times S179CutbackDL$$

$$S179AL = 0.90 \times S179CutbackAL$$

## **II) Application of section 179 expenses**

$$S179PayExp = \text{£}350 \times PMemNo + \text{£}500 \times (AMemNo + DMemNo)$$

And

If  $(S179PL + S179DL + S179AL) < \text{£}50$  million,

$$S179WUExp = (S179PL + S179DL + S179AL) \times 0.03$$

If  $\text{£}50\text{million} \leq (S179PL + S179DL + S179AL) < \text{£}100$  million,

$$S179WUExp = (S179PL + S179DL + S179AL) \times 0.02 + \text{£}0.5 \text{ million}$$

If  $(S179PL + S179DL + S179AL) \geq \text{£}100$  million,

$$S179WUExp = (S179PL + S179DL + S179AL) \times 0.01 + \text{£}1.5 \text{ million}$$

## **III) Total liabilities on Section 179 basis**

$$S179TL = S179PL + S179DL + S179AL + S179PayExp + S179WUExp$$

**Summary of discount rate assumptions to be used in calculating annuity factors relevant to pensions with different levels of indexation and revaluation**

**Factors on the marked-to-market MFR basis for pensioners**

Level of pensions increase	Discount rate to use
Fixed at p% a year	$(1 + \text{Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield}) / (1 + p\%)$
Full RPI	FTSE Actuaries Government Securities Index-linked annualised Real Yield Over 5 years (assuming 5% inflation) Index
RPI to maximum of:	<i>(example caps shown – switch over point from conventional to real gilt yields is cap of 2.5%)</i>
2%	$(1 + \text{Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield}) / 102\%$
5%	FTSE Actuaries Government Securities Index-linked annualised Real Yield Over 5 years (assuming 5% inflation) Index + 0.5%
8%	FTSE Actuaries Government Securities Index-linked annualised Real Yield Over 5 years (assuming 5% inflation) Index

Level of pensions increase	Discount rate to use
RPI with a minimum of p% and a maximum of:	<i>(example caps shown – switch over point from conventional to real gilt yields is cap of 2.5%)</i>
2%	(1 + Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield ) / 102%
5%	<p>Minimum of</p> <ul style="list-style-type: none"> <li>• (1 + Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield ) / (1 + p%)</li> <li>• FTSE Actuaries Government Securities Index-linked annualised Real Yield Over 5 years (assuming 5% inflation) Index + 0.5%</li> </ul>
8%	<p>Minimum of</p> <ul style="list-style-type: none"> <li>• (1 + Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield ) / (1 + p%)</li> <li>• FTSE Actuaries Government Securities Index-linked annualised Real Yield Over 5 years (assuming 5% inflation) Index</li> </ul>
None	Annualised redemption yield on FTSE Actuaries Government Securities 15-year Yield

### Factors on long-term MFR basis for non-pensioners

Level of pensions increase	Discount rate to use
Fixed at p% a year	$1.08 / (1+p\%) - 100\%$
Full RPI	$1.08 / 1.04 - 100\%$

Level of pensions increase	Discount rate to use
RPI to maximum of:	
2%	1.08 / 1.02 – 100%
3%	1.08 / 1.0275 – 100%
5%	1.08 / 1.035 – 100%
8%	1.08 / 1.04 – 100%
RPI with a minimum and maximum	
min p% (2.5>p0), max 5%	1.08 / 1.035 – 100%
min p% (p≥2.5), max 5%	1.08 / ( max(1.0375, (1 + p%) ) – 100%
min p% (p>0), max 8%	1.08 / ( max(1.04, (1 + p%) ) – 100%
None	8%

Factors for discount rates for MFR valuations are in line with actuarial guidance on performing MFR valuations in GN27 Appendix 2, paragraphs A and B1.

Where  $MFRPLEqEase > 0$  (that is, allowance is made for the equity easement in the valuation of pensioner liabilities on the MFR basis):

- for the “gilt” component of the pensioner liabilities use the pensioner interest rates described above (separately for pre 1997 and post 1997 elements), and
- for the “equity easement” component use the non-pensioner interest rates described above but with references to 1.08 and 8% in the column headed “Discount rate to use” replaced by 1.1 and 10% respectively for both the rate in deferment and in payment (separately for pre 1997 and post 1997 elements).

### **Factors on section 179 basis (under assumptions guidance A3)**

The rates to be used at the final conversion stage (c)(I) where benefits are turned from full scheme benefits on the section 179 basis to “protected liabilities” on the section 179 basis are those laid out in the PPF’s guidance on performing section 179 valuations. The following table sets out the derivation of discount rates for different pension increases on a basis consistent with this guidance.

Level of pensions increases in payment	Discount rate to use
RPI to maximum of 2.5%	Maximum of <ul style="list-style-type: none"> <li>• 50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 5 years assuming 5% inflation and 0% inflation – 0.5%</li> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 2.5%</li> </ul>
RPI to maximum of 2%	Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 2%
RPI to maximum of 5%	Maximum of <ul style="list-style-type: none"> <li>• 50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 5 years assuming 5% inflation and 0% inflation – 0.75%</li> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 5%</li> </ul>
RPI to maximum of 8%	Maximum of <ul style="list-style-type: none"> <li>• 50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 5 years assuming 5% inflation and 0% inflation -1%</li> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 8%</li> </ul>

Level of pensions increases in payment	Discount rate to use
RPI with a maximum of 5% and a minimum of p% (p>0)	Minimum of <ul style="list-style-type: none"> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – p%</li> <li>• Maximum of               <ul style="list-style-type: none"> <li>• 50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 5 years assuming 5% inflation and 0% inflation – 1%</li> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 5%</li> </ul> </li> </ul>
RPI with a maximum of 8% and a minimum of p% (p>0)	Minimum of <ul style="list-style-type: none"> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – p%</li> <li>• Maximum of               <ul style="list-style-type: none"> <li>• 50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 5 years assuming 5% inflation and 0% inflation – 1.25%</li> <li>• Annualised yield on FTSE Actuaries Government 10 Year Fixed Index – 8%</li> </ul> </li> </ul>
None	Annualised yield on FTSE Actuaries Government 10 Year Fixed Index

### Revaluation assumptions for pre-retirement discount rates

For scheme benefits, where revaluation will be at an unknown mix of statutory revaluation (RPI with a 5% a year cap applied cumulatively over the whole period from leaving service to pension age), Guaranteed Minimum Pensions generally increasing at a fixed rate of 4.5% or more or in line with earnings increases and flat-rate pensions for those who left before 1991.

On the MFR basis use: 1.09 / 1.045 – 100%

On the section 179 basis use:

50% of the sum of the FTSE Actuaries Government Securities Index-Linked Real Yields over 15 years assuming 5% inflation and 0% inflation – 0.7% as in the PPF’s section 179 assumptions guidance A3.

**Assumptions made where input information has not been provided**

Where MFR% is provided but MFRTL, MFRPL, MFRDL and MFRAL are missing

If MFR% = 120%, then

• Total liabilities (including MFR expense allowance)	MFRTL	= MFRAss / 1.25
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Otherwise

• Total liabilities (including MFR expense allowance)	MFRTL	= MFRAss / MFR%
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Where MFRPL, MFRDL and MFRAL are missing

• Liabilities for pensions in payment (possibly including the MFR expense allowance)	MFRPL	= 0.45 x MFRTL
• Liabilities for deferred members (possibly including the MFR expense allowance)	MFRDL	= 0.25 x MFRTL
• Liabilities for active members (possibly including the MFR expense allowance)	MFRAL	= 0.3 x MFRTL
• MFR expense allowance (if not included in separate liability figures for pensioners, deferreds, actives)	MFRExp	= 0

Where information on scheme pension indexation policy (IndMeth) is incomplete:

Fixed increases selected, but % not given	Assume zero increases
Percentage of the increase in the RPI, but % not given	Assume zero increases
Index linking with RPI up to a maximum, maximum not given	Assume zero increases
Index linking with RPI up to a maximum and minimum, maximum and minimum not given	Assume zero increases
Not applicable selected	Assume zero increases
Where more than one option has been selected or the information provided is unclear or misleading	Assume zero increases

Where the total of the percentages of the assets in each asset class (IP% + Eq% + FI% + Pr% + Ca% + Ot%) is less than 100% (or no breakdown is provided), Ca% will be increased to give a total of 100%.

If AMemNo + DMemNo + PMemNo = 0 but total membership number, TotMemNo is provided then

• Pensioner members	PMemNo	=0.45 x TotMemNo
• Deferred members	DMemNo	=0.25 x TotMemNo
• Active members	AMemNo	=0.3 x TotMemNo

Where average ages of different classes of members are not provided the following will be assumed

• Pensioner members	PAvAge	66
• Deferred members	DAvAge	46
• Active members	AAvAge	46

Note also that where average ages have been provided, if they fall out of particular ranges, they will be subject to the following adjustments

• Pensioner members	PAvAge	PAvAge>120 reduced to 66, minimum of 25
• Deferred members	DavAge	DAvAge>75 reduced to 46, minimum of 25
• Active members	AavAge	AAvAge>75 reduced to 46, minimum of 25