

Shrinkage and Leakage Model Modification No. 04 Report

Report on the proposed revision to the Low Pressure Service Leakage Calculations and Inclusion of Theft and Own Use Gas definitions within the Shrinkage and Leakage Model

Version 1.0

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Overview:

Gas Distribution Network Operators (GDNs) have an obligation under *Special Condition 1F Part D* of the current Gas Transporter Licence to maintain the Shrinkage and Leakage Model. The Shrinkage and Leakage Model (SLM) comprises a spreadsheet model and methodology documentation. In addition, under *Special Condition 1F*, any modifications to the SLM, have to go through the modification process defined within *Special Condition 1F Part E*. Within this modification process is the obligation to consult with relevant shippers and any other interested parties.

In February 2012, National Grid consulted on a proposed change to the low pressure service calculation for its networks and in March 2012 Scotia Gas Network issued an equivalent consultation.

However, given the interaction of the change with the finalisation of the RIIO-GD1 proposals, NGGD and SGN agreed not to proceed further with the change process at the time. Instead, it was agreed by all GDNs to pursue the change in Formula Year 2013/14 so that the proposed changes to the model would apply from 2013/14 onwards and the linked changes to the Shrinkage and Leakage baseline volumes would apply to the RIIO-GD1 years.

Consultation No. 04 sought respondents' views on the revised Shrinkage and Leakage baseline volumes for all GDNs in line with the revised methodology previously consulted on.

This document provides a report on the Consultation and details the proposed implementation of the modifications in the SLM.

Contact name and details: Roy Malin, Commercial Specialist, National Grid Gas Distribution

e-mail: roy.malin@nationalgrid.com

Context

The RIIO GT Licences contain controls around the estimation of emissions from gas distribution systems; these controls being in place to support the Shrinkage and the Environmental Emissions Incentives.

Special Condition 1F of the GT Licences places a number of obligations on Gas Distribution Network Operators (GDNs), including:

- maintaining a Shrinkage and Leakage Model;
- annual report of emissions;
- consultation on modifications to the Shrinkage and Leakage Model

Associated Documents

The GT Licence can be found on the Ofgem website; all other documents can be found on the Joint Office website.

GT Licences, Special Condition 1F

Leakage Model Modification Consultation No.4 July 2012	-	Joint Distribution Network Consultation
British Gas Representation to Leakage Model Consultation No.4	-	British Gas Representation
Scottish Power Representation to Leakage Model Consultation No.4	-	Scottish Power Representation
Independent Review of Leakage Model Modification Consultation No.3	-	GL Industrial Services UK Ltd
NGGD response SGN Leakage Model Consultation No. 3	-	National Grid Gas Distribution Representation
Centrica response SGN Leakage Model Consultation No. 3	-	British Gas Representation
Leakage Model Modification Consultation No.3 March 2012	-	Scotia Gas Consultation
Leakage Model Modification Consultation No.2 February 2012	-	National Grid Consultation
Independent Review of Leakage Model Modification Consultation No.2	-	GL Industrial Services UK Ltd
Centrica response NGD Leakage model consultation 2	-	British Gas Representation
Representation - Scotia Gas Networks LMM Cons 2	-	Scotia Gas Representation

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Summary

Special Condition 1F of the Gas Transporter Licence requires GDNs to maintain a Shrinkage and Leakage Model (SLM). Part of the obligation to maintain this model is to review the accuracy of the leakage estimation. The GDNs have identified an area of inaccuracy within the current SLM associated with the calculation of Low Pressure Service leakage.

A further obligation of Special Condition 1F is that GDNs consult with Shippers, and any other interested parties, on any proposed modifications to the leakage model. National Grid issued a consultation (No. 2) on the proposed modification to its leakage model on 23 February 2012 and this was followed by an equivalent consultation (No. 3) by Scotia Gas Networks.

However, given the interaction of the change with the finalisation of the RIIO-GD1 proposals, NGGD and SGN agreed not to proceed further with the change process at the time. Instead, it was agreed by all GDNs to pursue the change in Formula Year 2013/14 so that the proposed changes to the model might apply from 1 April 2013 and the linked changes to the Shrinkage and Leakage baseline volumes would apply to the RIIO-GD1 years.

Consultation No. 4 sought respondents' views on the revised Shrinkage and Leakage baseline volumes for all GDNs in line with the revised methodology previously consulted on.

This document provides a report on the Consultation and details the proposed implementation of the modifications in the SLM.

1. Introduction

1.1 Background

In February 2012, National Grid Gas Distribution (NGGD) issued a consultation proposing an update to the Leakage model for its Distribution Networks. The proposed changes to the model were to update the service population assumptions and to improve the modelling process such that the model better reflects the impact of service transfer activity. In March 2012, Scotia Gas Networks (SGN) issued a consultation proposing equivalent modifications in respect of its Distribution Networks. The consultations proposed that these modifications should be implemented such that they took effect for the final two years of the GDPCR1 price control period.

Full details of these consultations including any representations, Independent Expert reports and final consultation reports can be found on the Joint Office website; <http://www.gasgovernance.co.uk/sf/leakage>.

The general conclusion of the consultations was that the proposed methodology changes represented an improvement to the leakage estimation process. This view was supported by the Independent Experts reviews of the NGGD and SGN consultations. In addition, the Independent Expert reviews concluded that the proposed amendments had been incorporated within the model correctly and that the adjustments to the GDPCR1 leakage baselines proposed by NGGD and SGN had been calculated correctly.

However, concerns were expressed about the proposed timing of the changes and specifically the interaction with the finalisation of the RIIO-GD1 proposals. As a result, NGGD and SGN agreed not to proceed further with the change process at the time. Instead, it was agreed by all GDNs to pursue the change in Formula Year 2013/14 so that the proposed changes to the model might apply from 1 April 2013 and the linked changes to the Shrinkage and Leakage baseline volumes would apply to the RIIO-GD1 years.

As the proposed methodology changes had been subject to two consultations, it was agreed with Ofgem and at the Shrinkage Forum that there would be no further need to consult on this for the other two GDNs, Northern Gas Networks (NGN) and Wales & West Utilities (WWU). The GDNs agreed to produce an estimate of the impact that the model changes would have if implemented, and this formed the main part of the Leakage Model Modification Consultation No.4.

The impact of the proposed changes to the RIIO-GD1 leakage allowances is the same as those already consulted on by NGGD and SGN. However, since the levels of the current leakage allowances for the RIIO-GD1 period are different from those previously applying, the absolute level of the proposed revised allowances is different from those previously proposed.

From 1st April 2013, the GDN Licences refer to a Shrinkage and Leakage Model whereas previously they referred to a Shrinkage Model. The consultation set out the changes to the SLM documentation to include the existing calculation of the additional Theft of Gas and Own Use Gas elements for the calculation of Shrinkage.

1.2 Purpose of this Document

This Report fulfils the GDNs' obligation, under the GT Licence Special Condition IF.21, to "...make publicly available and submit to the Authority¹ a report setting out:

- (a) the modifications originally proposed;
- (b) the revised allowed Shrinkage and allowed Leakage volumes proposed pursuant to paragraph 1F.19 of this condition;
- (c) the representations (if any) that were made to the Licensee by other DN Operators, gas shippers or other interested parties and not withdrawn;

¹ Special Condition 1F.20(b) specifies that the report should be issued within 28 days of the close of the consultation.

- (d) any changes to the modifications and to the allowed Shrinkage and allowed Leakage volumes that are proposed as a result of such representations;
- (e) a copy of the independent expert's report referred to in 1F.24 of this condition;
- (f) an explanation of how the proposed modifications would better achieve the objective set out in paragraph 1F.13 of this condition; and
- (g) a timetable, developed in accordance with paragraph 1F.25 of this condition, for implementing the modifications originally proposed or any alternative modifications developed in the light of any representations made by other DN Operators, gas shippers or other interested parties, including the date with effect from which such modifications (if made) would take effect."

1.3 Independent Review

GDNs have an obligation, in line with Special Condition 1F, to appoint an Independent Expert to review the Leakage Model Modification and provide a report of that review, including the implications of the proposed changes, within 28 days of the close of the consultation. The report makes reference to the Independent Expert reviews of the original model modification consultations carried out in 2012.

1.4 Shrinkage and Leakage Allowances

The allowances applicable for these two incentives, for each year from 2013/14 to 2020/21 and for each Network, are set out in the Gas Transporter Licence. Proposed revisions to these baselines are included in Appendix A.

2. Outcome of the Consultation

2.1 Representations

The Consultation set out the changes to the Low Pressure Service leakage calculation previously consulted on in Consultations No. 2 and No. 3 and sought respondents' views on the revised Shrinkage and Leakage baseline volumes for all GDNs in line with the revised methodology.

Two responses to the consultation were received, from [British Gas](#) and [Scottish Power](#), the details of which are outlined below.

2.2 Representations in respect of the specific consultation questions

This section presents the respondents', British Gas (BG) and Scottish Power (SP), comments in respect of the specific questions presented in the consultation and the GDNs' response:

i. If the SLM is modified in the manner set out in Section 2.1, should the allowed Shrinkage and Leakage volumes be revised as set out in Tables A1 and A2 respectively?

BG: Whilst we agreed that the low pressure service pipe calculations could be amended to improve the shrinkage and leakage model, we do not agree with all the proposals in section 2 of the consultation. There has been no transparency over the calculations used by the GDNs in assessing the impact on the baselines over the whole GD1 period and so we can have no confidence that the cumulative calculations in table 2.1.2 are correct. We request that the underlying calculations are published to help users verify this modification. We are keen to understand how the basic assumptions for the baseline targets change over the GD1 period and how they interact with the actual service replacement over time.

We still have an outstanding question from the Shrinkage Forum – why are National Grid significantly more impacted by the service pipe change than the other GDNs? We feel that gas shippers need to understand the comparison to help make an informed decision about the impact on the model. The proposed changes in baselines for NGGD currently look out of place with the other GDNs and intuitively feel wrong.

GDN: The methodology used to determine the leakage volume reduction associated with service transfers was covered in the original National Grid's and Scotia Gas Network's consultations, was subject to verification by the independent expert and has been discussed at the Shrinkage Forum. The leakage reduction associated with including service transfers within the SLM has been estimated using the data used for establishing the revised service populations; the formula below illustrates the calculation:

Service Transfer Leakage = Transfers/km x Length x Leakage Rate x ASP/30 x CV/3.6x10⁶

The table below provides the relevant data and calculation for each LDZ:

LDZ	3 Years RRP Data			Re-lays /km	Transfers /km	Average Annual Length (km)	Leakage Rate m ³ /service @30mbarg	ASP mbarg	CV MJ/m ³	Annual Leakage Associated with Service Transfers GWh
	Length (km)	Re-lays	Transfers							
EoE	2,156	90,053	95,468	42	44	719	2.19			
EA (45%)	962					321		29.75	39.41	0.3
EM (55%)	1194					398		30.99	39.48	0.4
LN	1,071	44,180	33,615	41	31	357		26.32	39.35	0.2
NW	1,783	79,465	55,842	45	31	594		27.94	39.20	0.4
WM	1,199	60,801	41,609	51	35	400		27.03	39.30	0.3
NE	971	62,091	32,213	64	33	324		34.18	40.22	0.3
NO	819	52,118	25,299	64	31	273		34.65	40.30	0.2
SC	880	38,878	47,967	44	55	293		28.24	39.94	0.4
SE	1,195	79,711	36,133	67	30	398		27.49	39.10	0.3
SO	852	46,710	22,829	55	27	284		28.98	39.24	0.2
SW	757	35,828	29,065	47	38	252		29.79	39.28	0.2
WN	131	6,206	5,035	47	38	44		33.04	39.23	0.04
WS	404	19,125	15,515	47	38	135		33.43	39.29	0.1

This represents the anticipated leakage reduction associated with transferring PE services for one year's length of mains replacement. Each year's leakage reduction will be reflected in each remaining year of RIIO, i.e. there is a cumulative effect, which starts in 2011/12 (the first year after the re-baselining of service populations). Therefore, the impact for 2013/14 will be equivalent to three years leakage reduction, 2014/15 would be four years etc. As recognized in the consultation, the outturn impact of the methodology change will depend on the actual length of replacement and the actual number of service transfers (as well as any variation in ASP and CV). However, in order to project the impact on baselines it is necessary to make assumptions for these factors. The calculation uses the same data for the replacement lengths and number of service transfers that was used in estimating the service populations. The ASP and CV assumptions are those relating to 2010/11 and are those on which the original RIIO leakage and shrinkage allowances were based. The data provided above for NGGD and SGN was subject to review, and was supported by, the Independent Expert.

With regard to NGGD networks showing a greater impact in terms of leakage reduction associated with re-baselining service numbers, it is necessary to consider the methodology used to calculate this. The principle of the re-baselining methodology is that actual mains replacement data is used to infer the remaining service populations, e.g. if you have transferred 50 services per km of mains replacement it is deemed that there is 50 PE services per km connected to the remaining metallic mains and similarly the number of metallic services per km of metallic main is inferred from the average number of re-lays.

There are a number of factors influencing the leakage change associated with re-baselining the service numbers:

- The most significant factor is the number of service re-lays and transfers - the lower the number of re-lays, the lower the assumed number of remaining metallic services, which would lead to a larger leakage reduction than a network with more re-lays; and similarly for service transfers, although the impact is lower as the assumed leakage rate is lower².
- The proportion of metallic mains to PE mains in the network – the less metallic main a network has, the greater the leakage reduction will be.

² A metal service connection to a metallic main has a leakage rate of 10.6m³/service compared to 2.19 m³/service for PE connections to metallic mains.

- (c) The amount of leakage in the network – the leakage reduction values quoted are absolute values; however, some networks have significantly more leakage than others, and, therefore any change is likely to have a greater impact in absolute terms.
- (d) Other factors such as average system pressure and calorific value will also have an impact on the absolute values.

As can be seen from the RRP data above, the NGGD networks (with the exception of WM) and Scotland show a lower number of service re-lays/km than the other networks and these are the networks that show the highest impact. The NGGD LDZs are also generally larger than the other DNs' LDZs³, which again magnifies the impact.

The impact of re-baselining the service populations was estimated by creating a version of the 2010/11 leakage assessment using a model with the revised assumptions incorporated and comparing this to the original model. As indicated previously, the Independent Expert's reviews of NGGD's and SGN's consultations, confirmed that the methodology had been incorporated within the new model correctly and that the adjustments to the GDP/CR1 leakage baselines proposed by NGGD and SGN had been calculated correctly.

SCP: As a Shipper, Scottish Power is limited in the degree of verification that we can undertake to ascertain whether or not the volumes that have been presented in the table are a reasonable estimate of the level of shrinkage. We understand that the original estimate of service populations was established in the early 1990s and has been updated with further estimates for individual LDZs where deemed appropriate.

The service leakage rates currently in use are based on a leakage survey that took place in 2002/03. This survey was undertaken by National Grid when it owned and operated all distribution networks in the UK. Since DN Sales took place, individual Network Owners have not undertaken their own leakage survey in order to update the assumptions made in the original model.

From the information presented in the consultation, we ascertain that the level of shrinkage appears to be low and therefore conclude that there is limited incentive for Network Owners to undertake a full review of the model assumptions. The AUGE has been appointed to estimate the volume of unidentified gas. Current estimates are that the volume of unidentified gas could be in excess of £200m. It therefore would seem unlikely that overall Shrinkage volumes should be reducing particularly in light of the assumptions that are being made on the level of theft which is present within the market.

We believe that in order to give increased certainty and assurance to the market, DNOs should undertake a full review of the leakage model to determine if it remains fit for purposes. At the present time Shippers and in particular SSP Shippers and their customers incur the majority of risk in the gas market. This situation cannot be permitted to continue.

GDN: The GDNs have a licence obligation to review the SLM annually and this includes all elements and associated assumptions of the leakage estimation process. The methodology employed to estimate leakage from the UK's gas distribution networks, the pressure decay method, is recognised worldwide as being the most robust and accurate methodology; however, this comes at a significant cost. The national leakage tests carried out in 2002/03 cost in the order of £10m to complete and to repeat these tests and on a regional basis would increase the likely cost significantly. The GDNs have identified a number of areas where improvements can be achieved, such as the present consultation on LP services and the work being carried out on AGI Venting. The GDNs focus attention on areas where the modelling improvements can be achieved in a cost effective manner and where these improvements may drive investment or operational changes leading to emissions reduction.

³ With the exception of SE; however, this LDZ has a much greater proportion of re-lays to transfers and, therefore, shows less impact in the analysis.

ii. Is it appropriate to include the proposed text set out in Section 2.2 so that the SLM reflects the existing processes for determining Theft of Gas and Own Use Gas volumes within Shrinkage?

BG: Yes, we agree it is appropriate to include the wording for TOG and OUG.

SP: As we are unable to verify the assumptions made in the model, we are unable to provide comment on the text to be inserted in the UNC.

GDN: The proposed wording for TOG and OUG in the consultation reflects the current methodologies used to determine these factors. This is included so as to complete the Shrinkage and Leakage Model documentation.

2.3 General Comments from Representations

In addition to comments on the specific questions in the consultation, the following general comments were made by British Gas (BG) and Scottish Power (SCP):

BG: We have concerns that the Above Ground Installations project will incur further delays if this review and modification is implemented. We would rather the net impact from both the service pipe transfers and the AGI project were completed together and save a potential seesaw effect on the shrinkage baselines. We hope that by implementing the two changes together would encourage the GDNs to finish and report back their findings on the AGI venting.

GDN: The LP service modification and AGI Venting proposals were originally raised at the same time. However, at the request of attendees at the Shrinkage Forum, a study was initiated to gather empirical data to support the assessment of AGI venting, which has delayed this proposal. As indicated previously, the outcome of the NGGD and SGN consultations on the LP service modifications was a general agreement that the methodology resulted in an improvement to the leakage estimation process and, following agreement at the Shrinkage Forum, the shrinkage volumes applicable to 2013/14 have been calculated using the revised leakage model. Therefore, we believe it to be important to progress this model change independently of the AGI venting proposal to ensure that it is implemented in a timely manner and avoid potentially large end of period adjustments were the proposal not be approved in time. The AGI venting proposal is completely independent of the LP Service modification and its timing will not be affected by implementation of the LP Service modification at this time.

SCP: With reference to CSEP Shrinkage - We are disappointed that Network owners have not pursued this matter more robustly with iGTs. There is a clear obligation within the CSEP NExA for iGTs to provide a record of annual Shrinkage values to Large Transporters by 1st August each year. iGTs have so far failed to provide any information to Large Transporters and the provision of this information has not been pursued. While the level of Shrinkage on iGT Networks may be minimal, factors such as leakage, theft, own use gas etc do occur on iGT Networks. We would therefore request that Large Transporters formally write to iGTs requesting that they provide the required information as obliged under the CSEP NExA.

GDN: The issue of CSEP Shrinkage is unrelated to the proposed modification and has been discussed at the UNC Modification 0440 Workgroup. We consider that this ongoing Workgroup is the appropriate forum to discuss this issue.

3. The Modifications

3.1 Low Pressure Service Leakage

GDNs proposed this modification because the current leakage model does not correctly account for the impact of service replacement that has taken place since the original model assumptions were established.

The proposal is to use recent mains and service replacement data to estimate the current service populations. In 2009, the leakage model was updated to reflect the impact of re-laying steel services. This proposal recommends that the impact of transferring plastic services to be taken into account in the leakage estimation.

A full description of the proposed changes can be found in Appendix B. This is an extract from the original NGGD consultation.

3.2 Inclusion of Theft of Gas and Own Use Gas definitions within the Shrinkage and Leakage Model documentation

For the RIIO-GD1 Price Control period, the controls that were in place in respect of the Leakage model during the GDPCR1 Price Control period have been expanded to cover Shrinkage. Therefore, it is necessary to expand the documentation defining the Shrinkage and Leakage Model to include Theft and Own Use Gas.

The proposed text for inclusion within the Shrinkage and Leakage Model Documentation is given below:

- Theft of Gas

“This represents the overall level of Transporter Responsible theft, as defined in UNC Section N1.3.2, and is calculated as 0.02% of throughput.

- Own Use Gas

“This represents the overall level of gas used by the GDN for purposes of pre-heating at pressure reduction installations and is calculated as 0.0113% of throughput.

4. Independent Expert Review

GL Industrial Services UK Ltd was appointed as Independent Expert for both the NGGD and SGN Leakage Model Modification consultations. Alan Brown from GL, who carried out the review, has a long history of leakage estimation within the Gas Industry, having worked in this area for British Gas West Midlands, Transco and Advantica. Alan also carried out of the review of the previous model modification proposal in June 2009.

The Independent Expert's reviews can be found on the [Joint Office Website](#), along with this document.

The reviews were supportive of the proposal to establish current service populations based on the last three years mains and service replacement data and confirmed that this had been correctly implemented within the revised leakage model.

The reviews confirmed that the proposed inclusion of the impact on leakage of service transfers would improve the accuracy of the leakage modelling and that this had been correctly implemented within the revised leakage model.

The reviews confirmed that the proposed revision to the baseline volumes outlined in the consultation had been estimated correctly in accordance with the proposed methodology.

5. Facilitation of the Objectives in Special Condition 1F.13

Extent to which implementation of this Modification Proposal would better facilitate the achievement (for the purposes of each Transporters' Licence) of the Relevant Objectives:

Special Condition IF.13: The Shrinkage and Leakage Model must be designed to facilitate the accurate calculation and reporting of gas Shrinkage and Leakage in or from each Distribution Network operated by the Licensee.

The modification proposal facilitates the objectives of Special Condition IF.13. The Independent Expert's reviews of the original modification proposals supported National Grid's and SGN's assertions that the implementation of the revised Low Pressure Service methodology would provide a better assessment of leakage and the impact of service transfer activity on the leakage calculation.

6. Proposed Implementation Timetable

Subject to Ofgem approval, the GDNs propose to implement the revision to the SLM as follows:

Purpose	Applicable Period	Application Date
Environmental Emissions and Shrinkage Incentives	1 April 2013 to 31 March 2014 and subsequent years	From July 2014
Shrinkage Assessment and Adjustment	1 April 2013 to 31 March 2014 and subsequent years	From July 2014
Greenhouse Gas Reporting	1 April 2013 to 31 March 2014 and subsequent years	From July 2014
2014/15 Shrinkage Quantity Proposal	1 April 2014 to 31 March 2015 and subsequent years	From January 2014

7. Summary of Consultation

The GDNs have considered the representations to the consultation, as outlined in Section 2, and consider that the proposed revisions to Shrinkage and Leakage Allowances are appropriate for the proposed modifications to the methodology.

Taking into account this consultation and the previous consultations No.2 and No.3, the GDNs believe that, as the proposed modifications to the Low Pressure Service methodology provide a better assessment of leakage, it is appropriate for the leakage model to be amended to reflect the proposed modifications outlined in this consultation document. The GDNs believe that implementation of this modification would facilitate the objectives set out in Special Condition E9 paragraph 4(a).

In summary, implementation of this proposal would:

- i) Establish an estimate of current service populations using mains and service replacement data from the 2008/09, 2009/10 and 2010/11 formula years;
- ii) Amend the leakage model calculations to facilitate the inclusion of the impact of service transfer activity;
- iii) Update the Shrinkage and Leakage Model documentation to include the current Theft of Gas and Own Use Gas definitions; and
- iv) Amend the Shrinkage and Leakage Allowances within the GT Licence, as proposed in Appendix A.

It is proposed that, subject to Ofgem approval, GDNs will implement the revised Low Pressure Service methodology in respect of calculating leakage for 2013/14 and subsequent formula years.

Appendix A Proposed Revision to Baseline Volumes

This section includes any revision to the shrinkage and leakage volume allowances as result of the proposed modification.

A.1 Revised Volume Allowances

The GDNs consider that if the proposed modifications to the SLM were to be implemented, it would be appropriate for the shrinkage and leakage volume allowances to be revised as set out in Tables A1 and A2 respectively.

The derivation of these values can be found in section 3.1 of this document. The revised values reflect the actual impact of updating the current service population assumptions and an estimated impact of reflecting service transfer activity within the leakage model, as outlined in the previous modification consultation by NGGD and in our response to the shipper representations in Section 2.2i above.

The Independent Expert's reports on the previous NGGD and SGN proposed modifications to the Leakage Model confirmed that the adjustments to the then existing allowances, calculated in the same manner as the adjustments underlying these revised allowances, had been calculated correctly and in accordance with the proposed methodology.

Table A1 Revised Shrinkage Volume Allowances

Network Owner	Network	Shrinkage Volume Allowance (GWh)							
		13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
NGGD	EoE	526	515	503	490	479	467	455	444
	LN	289	282	274	266	259	252	245	238
	NW	388	378	367	356	346	334	324	314
	WM	330	323	316	310	302	295	289	281
NGN	NGN	455	445	433	423	412	401	390	379
SGN	SC	234	226	220	212	206	198	192	186
	SO	638	622	606	590	574	557	542	525
WWU	WWU	431	423	415	407	398	390	381	373

Table A2 Revised Leakage Volume Allowances

Network Owner	Network	Leakage Volume Allowance (GWh)							
		13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
NGGD	EoE	492	482	470	458	447	435	423	412
	LN	271	264	257	249	242	235	228	222
	NW	366	356	346	335	324	313	303	293
	WM	315	309	303	296	289	282	276	268
NGN	NGN	430	420	408	398	386	376	364	354
SGN	SC	218	210	204	197	190	183	176	170
	SO	605	589	573	557	541	525	509	493
WWU	WWU	406	397	390	382	373	365	357	349

Appendix B Supporting Analysis

B.1 Determination of service populations for new base year (2010/11)

B.1.1 Proposed methodology for application within the SLM

Each year, NNGD replace in the order of 1800-2000km of metallic main. When replacing a main, it is policy to not reconnect steel services, i.e. any steel service connections to the original main are replaced, or 're-laid', with PE services. Any PE services that were connected to the original main are transferred to the new main. Data regarding the level of mains replacement and any associated service 're-lays' or 'transfers' is included within the regulatory reporting to Ofgem. It is proposed to use this data to estimate the relative service populations over the past three years, thereby setting a new baseline from which the forward replacement and transfer of services can be taken into account in the same way as that in the current methodology.

The table below shows a summary the mains replacement data for the last three years:

GDN	Length of main replaced (km)	Number of Relays	Number of Transfers	Relays /km	Transfers /km
East of England	2,156	90,053	95,468	42	44
London	1,071	44,180	33,615	41	31
North West	1,783	79,465	55,842	45	31
West Midlands	1,199	60,801	41,609	51	35

To determine the relative populations of service connections to PE mains, we propose to use data relating to PE mains from the 2002/03 National Leakage Tests:

Number of Tests	Length of Main Tested (km)	Number PE Services	Number Steel Services	Total number Services	PE Service %	Steel Service %
81	7,039	770	14	784	98.20%	1.80%

To determine the baselines:

- i) the number of steel services per km of metallic main = service 're-lays' / length of main replaced
- ii) the number of PE services per km of metallic main = service 'transfers' / length of main replaced
- iii) the number of steel services connected to metallic mains⁴ = the number of steel services per km of metallic main x the length of metallic main in the network
- iv) the number of PE services connected to metallic mains⁵ = the number of PE services per km of metallic main x the length of metallic main in the network
- v) the number of service connections to PE mains⁶ in each low pressure network = total number of services – number of steel services
- vi) the number of PE service connections to PE mains = the number of service connections to PE mains x PE Services %
- vii) the number of steel service connections to PE mains = the number of service connections to PE mains x steel services %

B.1.2 Worked Example

For Cambridge network in Eastern (EA) LDZ, which is part of East of England Network:

Metallic Length = 256km; Total Number Services = 59,321

⁴ Text updated as per observation in Independent Expert's report

⁵ Text updated as per observation in Independent Expert's report

⁶ The current leakage model identifies the leakage associated with service connections to both metallic and PE mains. However, the 2002/03 National Leakage Tests determined the leakage from service connections to PE mains to be zero. For completeness, it is proposed to maintain the service connections to PE mains within the current leakage model, albeit that this will return zero leakage.

Number Steel Service Connections to Metallic Mains	= Relays/km x Metallic Length
	= 42 x 256
	= 10,752
Number PE Service Connections to Metallic Mains	= Transfers/km x Metallic Length
	= 44 x 256
	= 11,264
Total no. service connections to metallic mains	= 10,752 + 11,264
	= 22,016
Total no. service connection to PE mains	= 59,321 – 22,016
	= 37,305
Number PE service connections to PE mains	= 37,305 x 98.2%
	= 36,634
Number steel service connections to PE mains	= 37,305 x 1.8%
	= 671

In summary:

No. steel service connections to metallic mains	No. PE service connections to metallic mains	No. PE service connections to PE mains	No. steel service connections to PE mains	Total No. of service connections ⁷
10,752	11,264	36,634	671	59,321

B.2 Calculating the Impact of Service Population Movement

The annual service workload activity is recorded, on an LDZ basis, and reported to Ofgem through the regulatory reporting process. The leakage model currently uses this information to estimate the impact of replacement of steel services with PE. It achieves this by apportioning the total LDZ service replacement workload by the proportion of steel services within each constituent network within the LDZ. It is proposed to extend this methodology to take account of the impact of the service transfer activity. The proposed revised methodology to capture the leakage reduction for both service transfers and replacement activity is shown in the worked example below.

B.2.1 Worked Example

Assume that:

- the total number of steel and PE services connections to metallic mains in the LDZ for the baseline year (2010/11) is 255,000 & 270,000, respectively, calculated using the methodology above for each network within the LDZ;
- 20,000 steel services are replaced in 2011/12 and 25,000 in 2012/13, i.e. 45,000 in total by 2012/13;
- 25,000 PE services are transferred in 2011/12 and 30,000 in 2012/13, i.e. 55,000 in total by 2012/13; and
- there are now 60,000 consumers attached to the network

The number of services in 2012/13 for the Cambridge network, using the service populations calculated in B.1.2 above, would be calculated as:

1. Number of steel services connections to metallic mains
 - = Baseline No. – No. Replaced in LDZ x % of Service Category
 - = 10,752 – 45,000 x 10,752 / 255,000
 - = 10,752 – 45,000 x 4.2%
 - = 10,752 – 1,897
 - = 8,855
2. Number of PE service connections to metallic mains
 - = Baseline No. – No. Transferred in LDZ x % of Service Category
 - = 11,264 – 55,000 x 11,264 / 270,000

⁷ Text updated as per observation in Independent Expert's report

$$\begin{aligned}
 &= 11,264 - 55,000 \times 4.2\% \\
 &= 11,264 - 2,295 \\
 &= 8,969
 \end{aligned}$$

3. Number of steel service connections to PE mains

$$\begin{aligned}
 &= \text{Base year number} \\
 &= 671
 \end{aligned}$$

4. Number of PE service connections to PE mains

$$\begin{aligned}
 &= \text{Total no. connections} - \text{All other service connections} \\
 &= 60,000 - (8,855 + 8,969 + 671) \\
 &= 41,505
 \end{aligned}$$

B.3 Determination of Revised Allowed Shrinkage and Leakage Volumes consistent with Proposals

The GDN Licence⁸ states 'Any modification that the Licensee proposes to The Shrinkage and Leakage Model pursuant to the SLM Review must, where appropriate, specify such revised allowed Shrinkage and allowed Leakage volumes for each Distribution Network, as would maintain the incentive properties of the Shrinkage Allowance Revenue Adjustment and of the Environmental Emissions Incentive, at the same levels as those applicable before the proposed modification.'

To determine revised allowed Shrinkage and Leakage volumes consistent with the proposed modifications such that the Shrinkage and Environmental Emissions incentives properties remain at the same level as those applicable prior to the proposed change, the output of the proposed revised model has been compared to that of the current leakage model, v1.3.

B.3.1 Impact of Changes to the Low Pressure Service Calculation

The impact of reflecting the new service populations has been estimated by comparing the revised leakage model output with that of the current model using 2010/11 data.

The impact of reflecting the leakage reduction associated with the movement in the service population has been estimated using the lengths of planned mains replacement and the relative proportions of service connections to metallic mains (shown Appendix B.1).

- The impact of service transfers is calculated as:
 - Mains Replacement Length x 'Transfers/km' x Leakage Rate x Average System Pressure (ASP)⁹
- The impact of service re-lays are already included in the current model.
- For estimating the impact in 2012/13, the total length of replacement from 2010/11 is taken into account, as it is a cumulative impact in the model.

Further detail of how this calculation is applied can be found in our response to the shipper representations in Section 2.2i above.

⁸ Special Condition 1F paragraph 19

⁹ ASP was omitted in error from the consultation document, but was included in the calculation of the impact of service transfers.